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ABSTRACT

A total of 57 species of blennioid fishes representing four families (Blenniidae, Chaenopsidae, Labrisomidae, Tripterygiidae) is reported from collections made by the authors in Belize and Honduras, Central America, during the period 1970 through 1978. Twenty of these species are reported for the first time from Belize, 40 for the first time from Honduras, and 15 for the first time from the Caribbean coast of Central America. Species accounts, presented for each species, include available information on habitat association, depth distribution, co-occurrence with other blennioid species, and geographic distribution. Where appropriate, other information relevant to the systematics and biology of certain species is included. Comparison of captures of blennioid species from different localities in Belize and Honduras reveals an inshore to offshore gradient in species richness—many more blennioid species are found in offshore habitats than occur at inshore (and especially mainland) habitats in areas we have sampled—but the analysis also reveals changes in the composition of assemblages of blennioid species along the inshore to offshore gradient. Recurrent group analysis resulted in recognition of five principal groups of blennioid fishes, accounting for 23 of the 57 species. Group I species are associated with offshore, shallow-water, coral-rich habitats and especially with shallow, windward portions of fringing-reefs and the Belize Barrier Reef. Group II species are associated with offshore, relatively deep-water (greater than 45 ft), coral-rich habitats and especially with fore-reef dropoff zones. Group III species are associated with offshore, shallow-water, coral-rich habitats and particularly with those in relatively quiet water such as patch reefs in atoll lagoons and patch-reef-like formations behind the Belize Barrier Reef. Group IV species are associated with offshore, very shallow water sites and especially with reefcrest intertidal pools or areas in the immediately adjacent subtidal. Group V species are associated with more inshore (but not mainland) shallow-water habitats, typically with rock and cobble or coarse coral rubble predominating. Captures of blennioid species from the Caribbean coast of Central America documented in this paper raise serious questions regarding the validity of Briggs' (1974) recognition of an entirely insular West Indian Zoogeographic Province and, more importantly, firmly demonstrate the need for additional collecting in the western Caribbean.

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The Division of Photography, Field Museum of Natural History, provided photographs of the charts and line drawings. Mr. Z. Jastrzebski, Department of Exhibition, Field Museum of Natural History, prepared the drawings. G. Glodek, B. Peyton, and G. Whitmire aided in preparation of the manuscript. Analysis of the data was largely done using the facilities of the Computation Center of the University of Chicago. Patricia H. Johnson typed both rough and final versions of the complete manuscript.

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This paper is based in part on the results of the Miskito Coast Expedition (1975) to Honduras and Nicaragua, jointly sponsored by Field Museum of Natural History, Northern Illinois University, and the University of Michigan at Ann Arbor.

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INTRODUCTION

This paper is an annotated checklist of the blennioid fishes from Belize and Honduras, Central America. The following families are treated: Labrisomi-

dae,[1] Chaenopsidae,[2] Tripterygiidae,[2] and Blenniidae. Records are presented for 57 species: Labrisomidae (32), Chaenopsidae (13), Tripterygiidae (5), Blenniidae (7) (table 1). Twenty of these species are recorded for the first time from Belize, 40 for the first time from Honduras, and 15 for the first time from the Caribbean coast of Central America. Available information on habitat association, depth distribution, co-occurrence with blennioid species, and geographic distribution is presented for each species, and, for a number of the more poorly known species, supplementary descriptive information is also presented.

Information on the marine fishes of the Atlantic coast of Central America (Yucatan Peninsula, Mexico to Panama) is scant and scattered (see Caldwell, 1963; Gilbert & Kelso, 1971; Robins, 1971b, 1972). By far the most significant work is that of Meek & Hildebrand (1923 to 1928) for Panama, now both old and of limited use because of the great number of subsequent taxonomic studies and because greatest attention was given to the Pacific side of Panama. Additional reports on small collections of fishes from Panama include those of Fowler (1916, 1917, 1930), Breder (1925), Rubinoff & Rubinoff (1962), and Caldwell & Caldwell (1964). Reports on several small collections of marine fishes from Costa Rica have been presented by Fowler (1916), Caldwell et al. (1959), Caldwell (1963), and Gilbert & Kelso (1971). Reports on two small collections from mainland Nicaragua are given by Fowler (1903, 1923). Reports on collections from Courtown Cays and Albuquerque Cays are also presented by Fowler (1944). In addition, reports have been presented on collections from San Andres (Fowler, 1944, 1950) and Isla Providencia (Old Providence) (Schmitt & Schultz, 1940; Fowler, 1944, 1950; Burgess, 1978). Breder (1927) reported on the first collection of fishes from Glovers Reef, Belize. The most recent report on the fishes of the Central American coastal area is that of Birdsong & Emery (1968), which includes records from Yucatan, Mexico, Belize, and Courtown and Albuquerque Cays off Nicaragua. Burgess (1978) in his unpublished master's thesis (University of Florida, Gainesville) provides valuable information on the geographic range and vertical distribution of some 53 species of blennioid fishes taken at Grand Cayman and Isla Providencia. In addition to these general references, there are numerous references to specimens from the Central American coast in taxonomic studies of various fish groups. References to these studies appear where appropriate throughout this paper.

The information on the blennioid fishes of Belize and Honduras presented in this paper is the result of a number of separate expeditions. D. W. and T. A. Greenfield, along with several collaborators, conducted a survey of the fishes of Belize from 1970 through 1978. This work resulted in a total of nearly 200 marine collections. The second major effort was made during the Miskito Coast Expedition in 1975. This expedition, jointly sponsored by Field Museum of Natural History, Northern Illinois University, and the University of Michigan Museum of Zoology, resulted in 31 marine collections from Honduras. In addition to the material collected by us, we have also examined Belize specimens deposited at the University of Miami Rosenstiel School of Marine and Atmospheric Science [material collected mostly by W. A. Starck II and reported by Birdsong & Emery (1968)]. An additional collection of fishes made in Belize by Mr. John W. Cooper

[1]Usage of this name follows George & Springer (1980).

[2]We choose to follow Rosenblatt (1959), Stephens (1963), and George & Springer (1980) in recognizing as distinct the Chaenopsidae and the Tripterygiidae.

(JWC station numbers) of the Smithsonian Institution, from Carrie Bow and Southwater Cays, was also examined.

Collecting sites in Belize and Honduras are indicated in Figures 1 and 2. Abbreviations for localities in Belize are: (AC) Ambergris Cay; (BC) Bugle Cays; (BZC) Belize mainland, sites near Belize City; (GPL) Belize mainland, southern lagoon at Gales Point; (BRB) Barrier Reef, 1 km south of Buttonwood Cay; (BRG) Barrier Reef at Gallows Point; (BRT) Barrier Reef at Tom Owens Cay; (CBC)

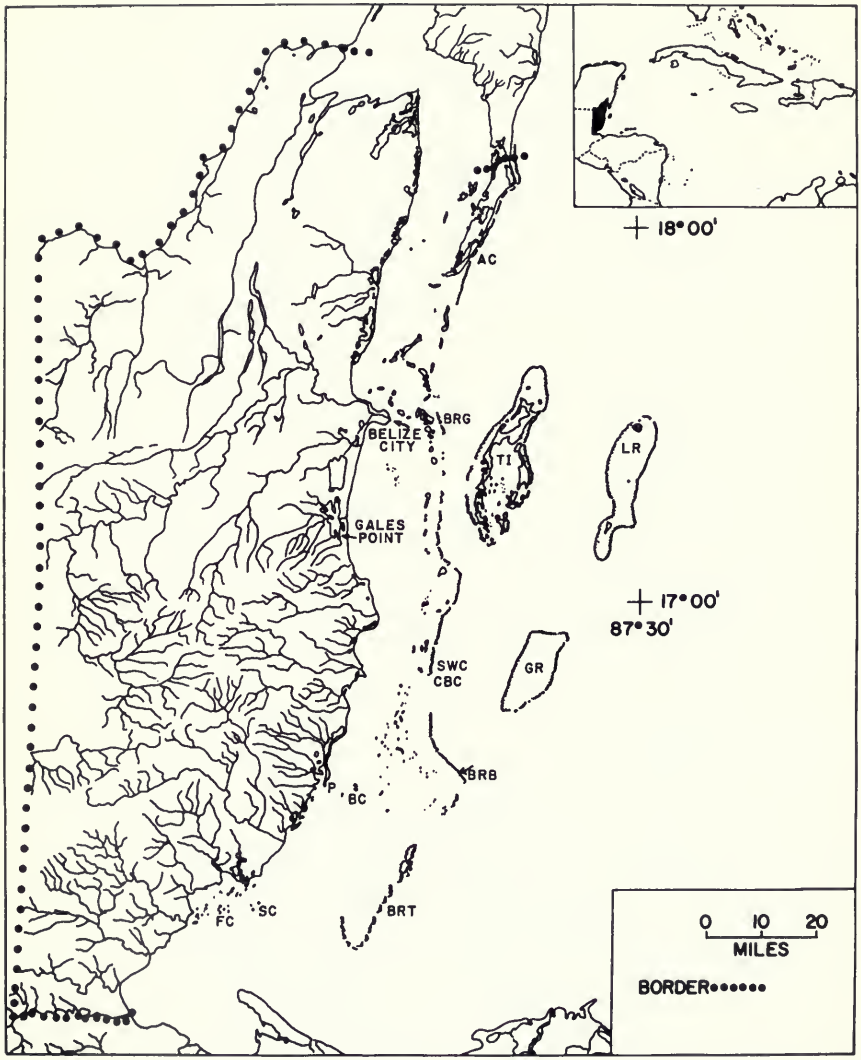

FIG. 1. Location of collecting sites in Belize. **AC**, Ambergris Cay; **BC**, Bugle Cays; **BRB**, Barrier Reef, 1 km S of Buttonwood Cay; **BRG**, Barrier Reef at Gallows Point; **BRT**, Barrier Reef at Tom Owens Cay; **CBC**, Carrie Bow Cay; **FC**, Frenchman's Cay; **GR**, Glovers Reef; **LR**, Lighthouse Reef; **P**, Placentia; **SC**, Snake Cays; **SWC**, South Water Cay; **TI**, Turneffe Island.

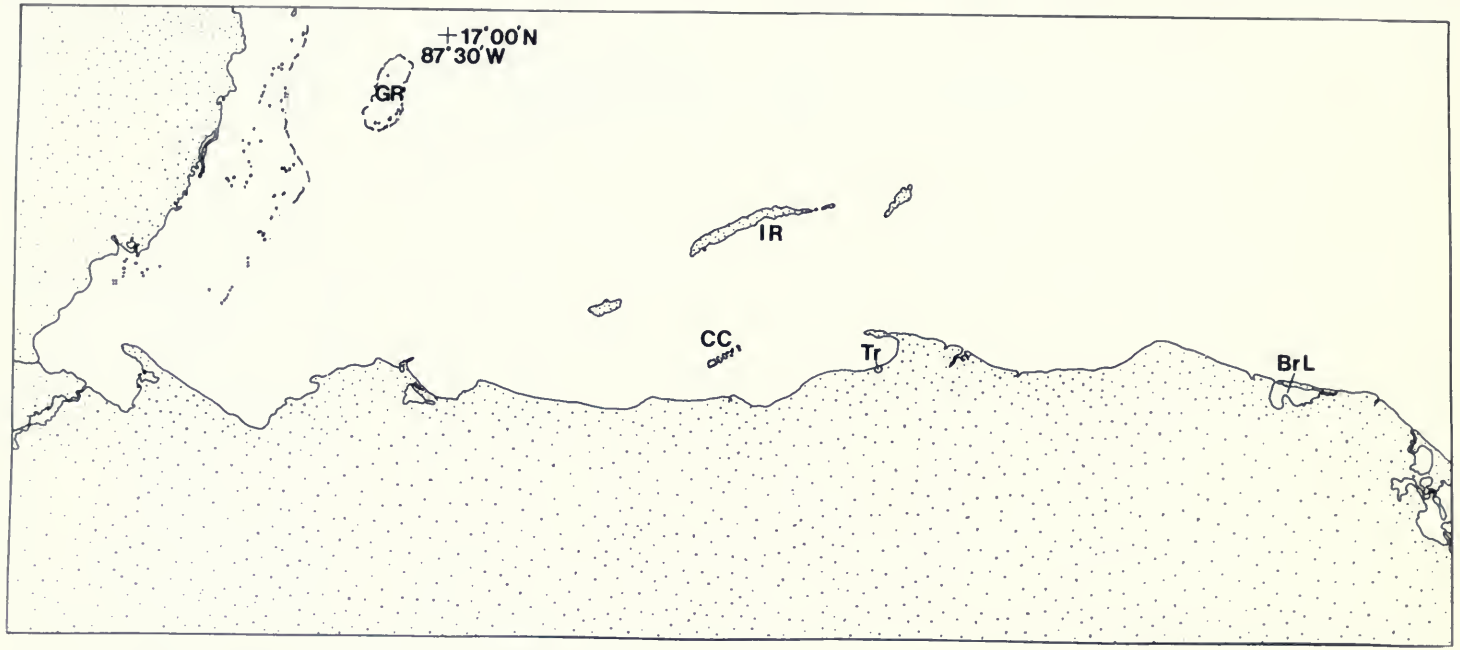

FIG. 2. Location of collecting sites in Honduras. **BRL,** Brus Lagoon; **CC,** Cayos Cochinos; **IR,** Isla Roatan; **TR,** Trujillo. Glovers Reef (**GR**), Belize, shown for reference purposes. Right margin = 84° W; left margin = 89° W.

Carrie Bow Cay; (FC) Frenchman's Cay; (GR) Glovers Reef; (LR) Lighthouse Reef; (P) Belize mainland near Placentia; (SC) Snake Cays; (SWC) South Water Cay; (TC) Tarpon Cay (just north of FC and not indicated on fig. 1); (TI) Turneffe Island. Abbreviations for localities in Honduras are: (CC) Hog Islands (Cayos Cochinos); (BRL) Honduras mainland, Cannon Island, Brus Lagoon; (TR) Honduras mainland, main pier at Trujillo; (IR) Isla Roatan.

Habitats represented in our collections are varied, ranging from mangrove swamps to well-developed coral atolls. The entire coastal area of Belize is bordered by mangrove swamps that often connect to inland lagoons, providing a gradation from brackish water to freshwater. Offshore, between the mainland and the Barrier Reef, the water tends to be clearer and more saline than along the coast; however, this area still receives a large amount of freshwater runoff from the large tropical rivers during the rainy season, and the water is more turbid and less saline than more offshore locations. In this zone are numerous mangrove-covered cays, often with shores of coral rubble covered with heavy algal growth. The bottom is generally characterized by wide areas of sand and *Thalassia*, although scattered coral heads are present off the cays. Toward the Barrier Reef the water becomes progressively clearer, more saline, and coral development increases.

The Barrier Reef of Belize, which is the second longest in the world, varies from 8 to 25 miles offshore and stretches southward from the Yucatan Peninsula, Mexico, for 168 miles into the Gulf of Honduras. Oceanic conditions generally prevail on the windward side of this reef; however, the coral development does not equal that of the offshore atolls.

There are three atolls in Belize: Turneffe Island, Lighthouse Reef, and Glovers Reef. Turneffe is closest to the Barrier Reef and has the most extensive land development, including mangrove islands within its lagoon. Lighthouse and Glovers Reefs are farther offshore and have the best coral development. These atolls lack large islands, although small cays are present. Their lagoons contain numerous patch reefs, and on the outside of the reef precipitous dropoffs are common. The conditions at these atolls are definitely oceanic and insular.

The habitats sampled in Honduras also varied widely. Roatan, a high island, has areas influenced by stream runoff that support mangrove growth. Rocky shores drop down to meet coral rubble and scattered coral heads and patch reefs within some of the bays. Offshore are well-developed coral reefs with precipitous dropoffs.

The Hog Islands (Cayos Cochinos) are high and rocky. The rocky cliffs drop down to the water's edge and often extend out into the water as points, separating beaches of sand and gravel. On the leeward side of the islands algae-covered rocks extend from shore down to meet a bottom of coral rubble, beyond which are found scattered coral heads that farther offshore grade into well-developed reefs with well-marked dropoffs. On the windward side of the islands beaches of coral-algal sand extend into areas of coral rubble, and these into areas of living coral in the form of fringing reefs.

METHODS

Descriptions

A number of the species discussed in this paper are known from very few specimens and/or from very few previously reported localities. For those species

TABLE 1. List of the blennioid fishes from Belize and Honduras discussed in this paper. The species number assigned to each species is used throughout this paper.

Species No.	Species	New to Belize	New to Honduras	Number of specimens	Number of lots
		LABRISOMIDAE			
Labrisomus					
1	*albigenys*	—	x	7	2
2	*bucciferus*	—	x	95	18
3	*gobio*	—	x	48	10
4	*guppyi*	—	x	270	29
5	*haitiensis*	—	x	70	18
6	*kalisherae*	—	x	196	11
7	*nigricinctus*	x	x	41	13
8	*nuchipinnis*	—	—	71	16
Malacoctenus					
9	*aurolineatus*	x	x	173	12
10	*boehlkei*	—	x	57	12
11	*delalandei*	—	x	22	4
12	*erdmani*	—	x	40	9
13	*gilli*	—	—	156	23
14	*macropus*	—	x	166	21
15	*triangulatus*	—	x	254	32
Paraclinus					
16	*barbatus*	x	—	2	1
17	*cingulatus*	—	x	1	1
18	*fasciatus*	—	x	27	5
19	*infrons*	x	—	7	6
20	*marmoratus*	x	—	2	2
21	*nigripinnis*	—	x	121	14
Starksia					
22	*atlantica*	—	x	70	22
23	*elongata*	x	x	4	3
24	*hassi*	x	—	2	2
25	*lepicoelia*	—	—	103	24
26	*nanodes*	—	x	57	20
27	*occidentalis*	—	—	53	14
28	*sluiteri*	x	—	6	4
29	*starcki*	—	x	1	1
Stathmonotus					
30	*gymnodermis*	x	—	1	1
31	*hemphilli*	—	x	1	1
32	*stahli tekla*	—	x	45	13
		TRIPTERYGIIDAE			
Enneanectes					
33	*altivelis*	—	x	113	28
34	*atrorus*	—	x	39	17
35	*boehlkei*	—	x	190	30
36	*jordani*	x	x	9	4
37	*pectoralis*	—	x	87	20
		CHAENOPSIDAE			
Acanthemblemaria					
38	*aspera*	—	x	140	25
39	*greenfieldi*	—	—	106	20
40	*maria*	x	—	2	2
41	*spinosa*	—	x	50	17
Coralliozetus					
42	*cardonae*	x	—	2	1

TABLE 1. *Continued.*

Species No.	Species	New to Belize	New to Honduras	Number of specimens	Number of lots
Emblemaria					
43	*caldwelli*	—	—	71	17
44	*hyltoni*	—	—	6	1
45	*pandionis*	—	—	25	4
Emblemariopsis					
46	*leptocirris*	x	x	7	6
47	*pricei*	—	x	10	7
48	*signifera*	x	x	5	5
Hemiemblemaria					
49	*simulus*	x	x	5	3
Lucayablennius					
50	*zingaro*	—	x	78	24
		BLENNIIDAE			
Entomacrodus					
51	*nigricans*	—	x	367	21
Hypleurochilus					
52	*aequipinnis*	x	x	18	3
53	*springeri*	x	x	9	7
Lupinoblennius					
54	*dispar*	x	x	19	4
Ophioblennius					
55	*atlanticus macclurei*	—	x	377	30
Parablennius					
56	*marmoreus*	x	—	1	1
Scartella					
57	*cristata*	x	x	33	7
Totals		20	40	3,939	

for which we felt that information obtained from Belize and Honduras specimens added substantially to our knowledge of the species in question, we present limited descriptive information. The methods used to obtain meristic, morphometric, and other quantitative data follow those used by the most recent revisor of the taxon being considered. All measurements are straight-line, point-to-point measurements taken to the nearest 0.1 mm with dial calipers or needle-point dividers, or to the nearest 0.01 mm with an ocular micrometer on a Wild M5 microscope. Unless otherwise noted, all lengths are the standard length (SL) in mm.

MATERIAL EXAMINED

In all cases material taken by us is listed first, by Field Museum of Natural History (FMNH) catalogue number, with the total number of specimens indicated in parentheses. The totals given for number of lots and number of specimens examined (table 1 and under each species account) are based solely on FMNH material. Only material collected by us is included in the ecological analyses for each species and group of species. Representative series of virtually all species collected by us in Honduras will be deposited at the Museum of Zoology, University of Michigan.

Any additional Belize material examined by us or referred to by previous authors is listed following the list of FMNH material. Abbreviations used in reference to additional material examined are: JWC—material obtained by John W. Cooper of the Smithsonian Institution at Carrie Bow and South Water Cays (material listed by original field number); UMML—material deposited at the Rosenstiel School of Marine and Atmospheric Science, University of Miami, and listed by UMML catalogue number.

Sampling Effort

Of more than 230 marine collections taken by us in Belize and Honduras between 1970 and 1978, 127 collections yielded one or more species of blennioid fish. Techniques utilized in obtaining the samples were varied, including ichthyocide (chemfish, noxfish, pronoxfish), anaesthetic (quinaldine), seines, handnets, and various combinations of these. Equally varied were the number of persons involved and the time spent in obtaining each collection.

Inspection of the original field data (on file at Field Museum of Natural History) allowed division of the collections into two categories: Class 1 collections were made utilizing broadcast collecting techniques (e.g., ichthyocide); Class 2 collections were much more biased in terms of sampling technique, e.g., the use of quinaldine to collect a particular species in a particular location. Obviously categorization of collections into one class or the other is partly subjective. Class 1 collections grade from those with partial to those with substantial bias in terms of the probability of collecting all blennioid species present at a given site. Nonetheless we felt it imperative to eliminate those stations clearly identifiable as Class 2 collections from certain categories of data analysis. Some 23 Class 2 stations were recognized, leaving 104 Class 1 stations. Where appropriate, this division is indicated in the following discussion.

There exist severe biases in our data with respect to depth of collection and site of collection—some depth intervals and localities being repeatedly collected, others represented by very few samples. These biases reflect solely the opportunities (or lack thereof) available to us over the eight-year period of this study.

In this paper depth intervals are reported in feet. This is because our depth gauges and hence all original field data were recorded in feet. We feel that to change all of these values to meters would result in a needless proliferation of decimal points.

We have tabulated sampling effort vs. depth of sampling using three different bases for recording depth of sampling (table 2). All three clearly show a bimodal distribution of sampling effort; most of our collections were taken in less than 15 ft or more than 50 ft of water.

Equally severe is sampling bias with respect to localities sampled (table 3). Although we have collected one or more species of blennioid fish at 18 separate localities in Belize and Honduras, three localities, Glovers Reef (64 stations), Carrie Bow Cay (27 stations), and the Hog Islands (11 stations), account for 80% of the total effort (127 stations).

Habitat Categories

In our efforts to discern a pattern in the distribution of individual species and groups of species, we have attempted to categorize stations according to

TABLE 2. Distribution of sampling effort (number of stations) by depth of capture. Three different ways of tallying depth of capture are used. The shallowest and greatest categories reflect tallies based respectively on the upper or lower recorded limits of sampling for a given station. The "average" depth category is a tally based on adding the arithmetic mean of the upper and lower depth limits recorded for a given sample added to the upper (shallowest) depth limit for that sample (as recorded in the field).

Depth (feet)	Shallowest depth	Average depth	Greatest depth
0 to 4	80	60	50
5 to 9	2	19	13
10 to 19	2	5	20
20 to 29	2	2	2
30 to 39	3	3	4
40 to 49	3	0	0
50 to 59	7	10	7
60 to 110	28	28	31
Totals	127	127	127

TABLE 3. Distribution of sampling effort (number of stations) by locality for Belize and Honduras.

Locality	Total no. of stations (Class 1 stations)	No. of species taken
A. HONDURAS—OFFSHORE LOCALITIES		
Hog Islands (CC)	11 (11)	38
Isla Roatan (IR)	8 (8)	25
Totals	19 (19)	44
B. BELIZE AND HONDURAS—MAINLAND LOCALITIES		
Belize City (BZC)	3 (3)	2
Placentia (P)	1 (1)	1
Gales Point (GPL)	1 (1)	1
Brus Lagoon (BRL)	1 (1)	1
Trujillo (TR)	1 (1)	5
Totals	7 (7)	7
C. BELIZE—CAYS INSIDE BARRIER REEF		
Frenchman's Cay (FC)	2 (2)	7
Bugle Cays (BC)	1 (1)	11
Snake Cays (SC)	1 (1)	10
Tarpon Cay (TC)	1 (1)	9
Totals	5 (5)	16
D. BELIZE—SITES ON BARRIER REEF		
Gallows Point (BRG)	3 (3)	12
Ambergris Cay (AC)	1 (1)	3
Buttonwood Cay (BRB)	1 (0)	6
Tom Owens Cay (BRT)	1 (1)	15
Carrie Bow Cay (CBC)	21 (21)	34
Totals	27 (26)	38
E. BELIZE—ATOLLS		
Glovers Reef (GR)	64 (42)	39
Lighthouse Reef (LR)	5 (5)	18
Totals	69 (47)	39

"habitat." Habitat categories, in the sense used in this paper, represent no more than an effort on our part to classify stations on the basis of dominant substrate. The categories recognized are listed and defined below (the number in brackets refers to total number of stations and number of Class I stations, respectively). The distribution of sampling effort with respect to locality and habitat category is given in Table 4.

H1—extensive live coral: well-developed reef formations in depths exceeding 30 ft, e.g., forereef dropoff areas [38, 30].

H2—extensive live coral: well-developed reef formations in depths less than 30 ft and in areas of relatively high wave energy, e.g., shallow, fringing reefs [20, 19].

H3—extensive live coral: well-developed reef formations in depths less than 30 ft and in areas of relatively low wave energy, e.g., patch reef sites in atoll lagoons [28, 19].

H4—rock: areas dominated by rocky substrates (ledges and cobble); no extensive coral formations [4, 4].

H5—coral rubble (coarse): areas in which dominant substrate consists of coarse coral rubble and sand, often with extensive development of algal mats [6, 6].

H6—coral rubble (fine) and sand: outer reef flat pools in very shallow (less than 2 ft) water [7, 6].

H7—grass beds and sand: areas dominated by extensive beds of marine spermatophytes [5, 5].

H8—mainland localities: includes all mainland locations [7, 7].

H9—other: all areas not appropriately placed on one of above; includes stations in mangrove channels, on beaches of sand and mud, on pier pilings, and stations representing broad mixtures of two or more habitat categories [12, 8].

It should be noted that categories H8 (mainland sites) and H9 ("other") are catchall categories, allowing the classification of stations not appropriately placed in categories H1 through H7. Although this is artificial, it prevents proliferation of additional categories, each of which would be represented by one or two stations. Our habitat categories are comparable with similar classifications produced by other workers (e.g., Clarke, 1977; Gilbert & Kelso, 1971). We recognize that our classification is oversimplified and expect that the number of habitat categories recognized by us in Belize will grow as we continue to collect. But, given the broadcast nature of ichthyocide collecting, we do not expect the number of useful categories to be much more than double the number recognized here, and we have found the scheme presented herein useful.

Data Analysis

Final tabulation of species occurrence by station, locality, depth interval, and co-occurrence with other blennioid species as well as the recurrent group analysis were performed using Fortran IV programs written by R. K. Johnson. Data analyses were performed using the IBM 360/370 computer at the University of Chicago Computation Center.

We attempted to estimate resemblance between major localities in Belize and Honduras (tables 3, 26, *viz.*, Hog Islands, Roatan, mainland localities, localities at cays inside the Belize Barrier Reef, localities at the Belize Barrier Reef, atolls) based on shared species of blennioid fishes. Peters (1968) lists a number of similarity indices useful in summarizing the relationship (in species composition) between two areas. We looked at data for six major areas in Belize and

TABLE 4. Distribution of sampling effort (number of stations) with respect to geographic locality and habitat category. Geographic localities as in Table 3. Note that all mainland localities are assigned (arbitrarily) to H8.

Locality	N_T	H1	H2	H3	H4	H5	H6	H7	H8	H9	N_H
A. Hog Islands	11	1	3	—	4	—	1	—	—	2	5
B. Roatan	8	1	1	1	—	—	—	2	—	3	5
C. Mainland sites	7	—	—	—	—	—	—	—	7	—	1
D. Cays inside Barrier Reef	5	—	—	—	—	4	—	—	—	1	2
E. Barrier Reef sites	27	6	12	5	—	2	1	—	—	1	6
F. Atolls	69	30	4	22	—	—	5	3	—	5	6
Totals	127	38	20	28	4	6	7	5	7	12	

N_T = number of stations (total); N_H = number of habitat categories represented.

Honduras, and this involved 15 pairwise computations for each index employed. We calculated values for four of the indices listed by Peters (1968):

(1) Jaccard Coefficient (termed "coefficient of community" by Peters, 1968; see Prentice & Kain, 1976)

$$SI = \frac{C}{(N_1 + N_2 - C)}$$

(2) Burt Coefficient (= Sørenson's Coefficient)

$$SI = \frac{2C}{(N_1 + N_2)}$$

(3) Otsuka Coefficient

$$SI = \frac{C}{\sqrt{N_1 \times N_2}}$$

(4) Preston Coefficient (see Preston, 1962, p. 418)

$$SI = 1 - Z$$

where Z is determined by solution (for Z) of the following expression

$$\left(\frac{N_1}{N_1 + N_2 - C}\right)^{\frac{1}{Z}} + \left(\frac{N_2}{N_1 + N_2 - C}\right)^{\frac{1}{Z}} = 1$$

In each case the following symbols apply:

C = number of species in common to two areas
N_1 = number of species in the area with fewer species
N_2 = number of species in the area with more species
SI = calculated index (similarity index)

Each of these indices varies between a minimum value of zero (C=0) and a maximum value of one ($N_1 = C$, $N_1 = N_2$). Values calculated for the 15 pairwise comparisons for each of the four indices considered were highly concordant (Kendall's Coefficient of Concordance, $W_{4,15} = 0.993$, $p << .01$, see Tate & Clelland, 1957; Downie & Heath, 1959), and we have chosen the Jaccard Coefficient for the comparisons presented in Table 26. This coefficient was used by Hagmeier & Stults (1964) in their analysis of North American mammal provinces.

In determining the composition of groups of associated blennioid species, we have used the recurrent group method developed by Fager (1957) and used by Inger & Chin (1962), Fager & McGowan (1963), and Fager & Longhurst (1968), among others. In this method a dichotomous index of relationship is calculated for every pair of species. A number of the indices listed by Peters (1968) could be used for this purpose, but we follow Inger & Chin (1962), Fager & McGowan (1963), and Fager & Longhurst (1968) in using an index that calculates the geometric mean of the proportion of joint occurrences (as in the Otsuka Coefficient) but applies a correction for sample size. The formula for this index, hereafter referred to as GMI, follows:

$$GMI = \frac{J}{\sqrt{N_A \cdot N_B}} - \frac{1}{2\sqrt{N_B}}$$

N_A is the number of occurrences of species A; N_B is the number of occurrences of species B; J is the number of joint occurrences; and species are assigned to letters such that $N_A \leqq N_B$. Pairwise values of GMI were calculated for all 57 species included in this paper, but only data from Class I stations were used in the recurrent group analysis.

For the 57 blennioid species included in this paper, the largest possible GMI value is 0.894 [(15) *Malacoctenus triangulatus*, $N_B = 31$; (55) *Ophioblennius atlanticus macclurei*, $N_A = 30$; actual GMI for this pair (J=20) is 0.566]. The largest observed GMI for species included in this paper is GMI = 0.700 [(4) *Labrisomus guppyi*, $N_B = 29$, (35) *Enneanectes boehlkei*, $N_A = 29$; J = 23].

In actual determination of recurrent groups we followed closely the criteria and methods of Fager (1957, pp. 589-591), except that species represented in only one or two Class I collections were eliminated from the analysis.

Fager & McGowan (1963) and Fager & Longhurst (1968) arbitrarily chose the value GMI $\geqq$ 0.500 as the breakpoint for deciding whether or not a given pair of species showed "affinity." The reason for choosing this value was that ". . . it was felt that the species should be found together in somewhat more than half their recorded occurrences if they are to be grouped together" (Fager & McGowan, 1963). Preliminary runs suggested that strict application of the 0.500 breakpoint to our data would result in a loss of information; rather few (table 5) of the 1,596 species-pair GMI values were at or above the 0.500 value (due in part we believe to biases in sampling effort). We therefore chose to perform the recurrent group analysis at three arbitrarily chosen predetermined breakpoint values: 0.500, 0.400, and 0.300.

Recurrent group analyses were performed for data based on Glovers Reef samples only, Belize samples only, and Belize and Honduras samples. Unless otherwise noted, all GMI values recorded in this paper are based on all Belize and Honduras (Class I) samples.

LABRISOMIDAE

The family Labrisomidae is represented in the tropical western Atlantic by seven genera and 45 described species. The seven genera are as follows (numbers in parentheses refer to total number of western tropical Atlantic species, number of species known from off the Central American coast, number of species represented in our material from Belize and Honduras): *Haptoclinus* (1,1,0), *Labrisomus* (9,9,8), *Malacoctenus* (8,8,7), *Nemaclinus* (1,1,0), *Paraclinus* (8,6,6), *Starksia* (15,9,8), and *Stathmonotus* (3,3,3). All of the genera and 37 of the 45 described species occur off the Central American coast. Of these, 32 species are represented in our collections, representing all but the deep-water monotypic genera *Haptoclinus* Böhlke & Robins, 1974, and *Nemaclinus* Böhlke & Springer, 1975. The names employed for labrisomid taxa treated in this paper are

TABLE 5. Frequency distribution of GMI values based on all 57 species, all Class I Belize and Honduras stations (see text for additional explanation).

GMI values (interval)	Frequency	Percent total	Cumulative percent	No. of values higher
$\leqq$ 0.000	1,013	63.47	63.47	583
0.001-0.100	150	9.40	72.87	433
0.101-0.200	189	11.84	84.71	244
0.201-0.300	108	6.77	91.48	136
0.301-0.400	68	4.26	95.74	68
0.401-0.500	43	2.69	98.43	25
0.501-0.600	18	1.13	99.56	7
0.601-0.700	7	0.44	100.0	0
Totals	1,596	100.00		

in accord with Springer, 1955a, 1955b, 1959a, 1959b; Böhlke, 1960; Gilbert, 1971; Böhlke & Robins, 1974; and Böhlke & Springer, 1975.

Labrisomus Swainson, 1893

The genus *Labrisomus* contains 18 species, nine in the eastern Pacific and nine in the western Atlantic. One of the western Atlantic species, *L. nuchipinnis*, also occurs in the eastern Atlantic. The Pacific members of the genus were revised by Hubbs (1953), and the Atlantic members were revised by Springer (1959a). Two additional species, one in the western Atlantic (Springer, 1959b) and one in the eastern Pacific (Springer & Rosenblatt, 1965), have been recognized since Springer's (1959a) revision.

All known western Atlantic species of *Labrisomus* occur off the Central American coast, and all except *L. filamentosus* Springer, 1959, are represented in our collections from Belize and Honduras. The latter species was described from the western Caribbean, and additional specimens have been reported from off Nicaragua and Hispaniola (Springer, 1959b; Springer & Rosenblatt, 1965); all specimens are known from depths in excess of 17 fathoms. Only one species of *Labrisomus* represented in our collections, *L. haitiensis*, is represented in samples taken at depths exceeding 20 ft (table 6).

(1) **Labrisomus albigenys** Beebe & Tee Van, 1928

This species has been reported from Haiti, Venezuela, the Campeche Banks off Mexico, and Belize (Springer, 1959a; Birdsong & Emery, 1968; Mago, 1970) and also from Antigua (C. R. Gilbert, pers. comm.). This constitutes the first record for Honduras.

Springer's (1959a, pp. 437-438) description of *L. albigenys* was based on five specimens, the holotype from Haiti and four specimens (FMNH 59875) from Cayos Arcos, Campeche Banks, Mexico. We present meristic and morphometric data for the seven specimens represented in our collections from Honduras (table 7). We note the rather high degree of bilateral asymmetry in pectoral-fin ray counts and in lateral line scale counts.

Ecological data.—*Labrisomus albigenys* appears to be the rarest species of *Labrisomus* in Belize and Honduras. We have collected *L. albigenys* only at the Hog Islands and only on two occasions. Both collections were in shallow water (< 18 ft), in areas of good coral development (Habitat = H2) and strong surge at the edge of the windward fringing reef on Little Hog Island. Species of *Labrisomus* taken with *L. albigenys* include *L. guppyi*, *L. kalisherae*, and *L. nigricinctus* (table 8). We have no detailed information on the single collection (UMML 9555) from Lighthouse Reef reported by Birdsong & Emery (1968). Lighthouse Reef is an area of good coral development.

Material examined.—A total of seven specimens from two collections. HONDURAS: CC, 84432 (5), 84433 (2). The Belize record (Birdsong & Emery, 1968) was based on a single collection from Lighthouse Reef (UMML 9555). We have not had the opportunity to examine this material.

(2) **Labrisomus bucciferus** (Poey, 1868)

This species is known from Bermuda, the Bahamas, Florida, the Greater and Lesser Antilles, and Central America, including Belize, Nicaragua, and Yucatan

TABLE 6. Distribution of capture records for 27 blennioid species taken in Belize and Honduras categorized by depth of capture. Based on all stations. Stations assigned to depth interval on basis of shallowest depth sampled. Only those species with one or more records assigned to a depth interval deeper than 00 to 04 ft are included in this table. All records for the 30 species *not* listed in this table were from stations at which the minimum depth of sampling was equal to or less than 4 ft.

Species	Depth interval (feet) 00-04	05-09	10-19	20-29	30-39	40-49	50-59	≧ 60	N_T	N_S
Labrisomus										
(5) *haitiensis*	11	1	0	1	3	0	2	0	18	—
	42	10	0	2	8	0	8	0	—	70
Malacoctenus										
(10) *boehlkei*	5	0	0	0	1	0	2	4	12	—
	39	0	0	0	1	0	13	4	—	57
(14) *macropus*	20	1	0	0	0	0	0	0	21	—
	163	3	0	0	0	0	0	0	—	166
(15) *triangulatus*	31	0	0	0	0	1	0	0	32	—
	251	0	0	0	0	3	0	0	—	254
Paraclinus										
(16) *barbatus*	0	0	0	0	0	0	0	1	1	—
	0	0	0	0	0	0	0	2	—	2
(19) *infrons*	0	0	0	0	0	0	1	5	6	—
	0	0	0	0	0	0	1	6	—	7
Starksia										
(22) *atlantica*	17	0	0	2	1	1	0	1	22	—
	59	0	0	8	1	1	0	1	—	70
(23) *elongata*	2	0	0	0	0	0	1	0	3	—
	3	0	0	0	0	0	1	0	—	4
(24) *hassi*	0	0	0	0	0	0	0	2	2	—
	0	0	0	0	0	0	0	2	—	2
(25) *lepicoelia*	6	0	0	2	3	1	1	11	24	—
	13	0	0	5	19	8	23	35	—	103
(26) *nanodes*	2	0	0	2	0	2	3	11	20	—
	2	0	0	10	0	10	7	28	—	57
(27) *occidentalis*	13	0	0	0	0	0	1	0	14	—
	47	0	0	0	0	0	6	0	—	53
(29) *starcki*	0	0	0	0	0	0	1	0	1	—
	0	0	0	0	0	0	1	0	—	1

Species	Depth interval (feet) 00-04	05-09	10-19	20-29	30-39	40-49	50-59	≧ 60	N_T	N_S
Stathmonotus										
(32) *stahli tekla*	12	0	0	0	1	0	0	0	13	—
	44	0	0	0	1	0	0	0	—	45
Enneanectes										
(33) *altivelis*	13	0	0	2	1	2	3	7	28	—
	45	0	0	15	1	16	19	17	—	113
(34) *atrorus*	0	0	0	0	1	1	1	14	17	—
	0	0	0	0	2	4	2	31	—	39
(35) *boehlkei*	27	0	0	1	1	0	0	0	29	—
	178	0	0	4	1	0	0	0	—	183
Acanthemblemaria										
(38) *aspera*	14	1	1	1	1	1	5	1	25	—
	68	20	13	5	16	1	14	3	—	140
(39) *greenfieldi*	19	0	1	0	0	0	0	0	20	—
	104	0	2	0	0	0	0	0	—	106
(41) *spinosa*	16	0	0	0	0	0	0	1	17	—
	48	0	0	0	0	0	0	2	—	50
Emblemaria										
(43) *caldwelli*	0	0	0	0	1	0	4	12	17	—
	0	0	0	0	1	0	27	43	—	71
(44) *hyltoni*	0	0	0	0	0	1	0	0	1	—
	0	0	0	0	0	6	0	0	—	6
(45) *pandionis*	1	1	1	0	0	0	0	0	3	—
	2	6	16	0	0	0	0	0	—	24
Emblemariopsis										
(46) *leptocirris*	3	0	0	0	0	1	0	2	6	—
	4	0	0	0	0	1	0	2	—	7
(47) *pricei*	4	0	0	1	0	0	1	1	7	—
	6	0	0	1	0	0	2	1	—	10
(48) *signifera*	1	0	0	0	0	0	1	3	5	—
	1	0	0	0	0	0	1	3	—	5
Lucayablennius										
(50) *zingaro*	0	0	0	0	0	2	3	19	24	—
	0	0	0	0	0	8	9	61	—	78

N_T = total number of records; N_S = total number of specimens.

TABLE 7. Meristic and morphometric data for specimens of *Labrisomus albigenys* from Hog Islands, Honduras.

Character	FMNH 84432					FMNH 84433		Data from Springer (1959a)
SL (mm)	26.0	36.8	37.6	41.0	48.2	48.9	49.6	5 (to 52.4)
Spinous dorsal	18	18	18	18	18	18	18	18 (all)
Soft dorsal	11	11	11	11	11	11	11	11 (all)
Anal, II +	18	18	18	18	18	18	18	18 (all)
Pectoral (left/right)	13/13	13/13	13/13	13/14	13/14	13/13	13/13	13 (all, counted on one side)
Lateral line scales (left/right)	42/42	42/42	42/44	40/41	41/43	42/44	42/44	41 to 44 (counted on one side)
Gill rakers on first arch (total, right side)	13	13	14	14	14	13	13	13 to 14
Head length*	362	353	348	354	353	352	351	334-344
Interorbital width (bony)*	38	35	37	37	33	33	34	—
Eye diameter (fleshy orbit)*	115	106	106	102	95	96	95	—
Snout length*	81	87	85	80	83	86	85	—
First dorsal-fin spine, length*	108	95	93	93	91	94	89	—
Pelvic fin, length of longest segmented ray*	246	250	253	249	251	274	248	—
Upper jaw length*	123	122	120	124	116	123	121	121-134
Ratio A (pelvic fin)	2.06	2.24	2.21	2.17	2.37	2.79	2.41	—
Ratio B (nuchal cirri)	0.90	1.00	1.08	1.07	1.13	1.12	1.18	—

*Expressed as thousandths of the SL.
Ratio A = (length of longest pelvic-fin segmented ray) / (length of shortest pelvic-fin segmented ray).
Ratio B = (width of right nuchal cirris base) / (width of interspace between nuchal cirrus bases).

(Springer, 1959a, 1959b; Birdsong & Emery, 1968; Böhlke & Chaplin, 1968). This constitutes the first record from Honduras.

Ecological data.—*Labrisomus bucciferus* was taken in collections in which sampling extended to 15 ft, but most specimens were taken in less than 4 ft. Although *L. bucciferus* was taken in a wide variety of habitats in Belize and Honduras (table 9), most (71% of 94 specimens) were taken in shallow water (< 4 ft), high wave energy, fore-reef areas (H2) or reef crest pools (H6). *Labrisomus bucciferus* was among the seven blennioid species to be taken in areas dominated by sea grass beds (H7). In Belize, all specimens of *L. bucciferus* were taken either at Barrier Reef sites (BRT, CBC) or at the offshore atolls (GR, LR). Additional Belize records include Turneffe Island and one Barrier Reef site (SWC). In Honduras *L. bucciferus* was taken at both the Hog Islands and Roatan. *Labrisomus bucciferus* was taken with all other species of *Labrisomus* except *L. albigenys* but shared highest affinity (GMI) values with *Malacoctenus gilli* and *Entomacrodus nigricans* (table 8).

Material examined.—A total of 95 specimens from 18 collections. HONDURAS: CC, 84443 (4), 84446 (1); IR, 84442 (11), 84444 (1), 84445 (1). BELIZE: BRT, 89406 (21); CBC, 89281 (2), 89353 (1), 89393 (3); GR, 39826 (1), 70989 (1), 71109 (1), 71147 (1), 77601 (2), 86040 (34), 86174 (1), 89407 (5); LR, 89409 (4). Additional Belize material examined: CBC, JWC-7 (2), JWC-23 (3); LR, UMML 9977; SWC, JWC-9 (2), JWC-24 (1); TI, UMML 9861.

(3) **Labrisomus gobio** (Valenciennes, 1836)

This species is known from the Bahamas, Greater and Lesser Antilles, and Central America, including Belize, Nicaragua, and off Yucatan (Springer, 1959a,

TABLE 8. Co-occurrence of species of *Labrisomus*. Values in upper half of the matrix (whole numbers) are actual number of records (number of stations) of co-occurrence (based on all stations). Values in the lower half of the matrix are calculated GMI values (based on Class I stations only).

			Co-occurring species							
Species	N_T	N_I	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1. *albigenys*	2	2	—	0	0	2	0	1	1	0
2. *bucciferus*	17	16	0	—	3	5	2	1	4	7
3. *gobio*	10	10	0	.11	—	10	2	0	6	1
4. *guppyi*	29	29	.17	.14	.49	—	4	5	11	5
5. *haitiensis*	18	17	0	0	.03	.09	—	1	2	1
6. *kalisherae*	11	11	.06	0	0	.19	0	—	2	8
7. *nigricinctus*	13	13	.06	.15	.39	.47	.01	.03	—	5
8. *nuchipinnis*	16	16	0	.31	0	.14	0	.48	.22	—

Listing of species sharing highest GMI values with species of *Labrisomus* (five highest values only).

1. *albigenys* 27 (.24), 37 (.20), 4 (.17), 55 (.17), 15 (.16)
2. *bucciferus* 13 (.60), 51 (.34), 8 (.31), 14 (.27), 18 (.21)
3. *gobio* 4 (.49), 15 (.48), 27 (.47), 9 (.40), 7 (.39)
4. *guppyi* 35 (.70), 55 (.62), 15 (.61), 37 (.57), 3 (.49)
5. *haitiensis* 33 (.41), 10 (.30), 38 (.23), 22 (.20), 25 (.20)
6. *kalisherae* 27 (.67), 57 (.53), 8 (.48), 55 (.46), 15 (.45)
7. *nigricinctus* 9 (.58), 37 (.57), 51 (.51), 4 (.47), 35 (.42)
8. *nuchipinnis* 21 (.54), 57 (.54), 13 (.49), 6 (.48), 9 (.38)

N_T = total number of stations; N_I = number of Class I stations.

1959b; Birdsong & Emery, 1968; Böhlke & Chaplin, 1968). This constitutes the first record for Honduras.

Ecological data.—*Labrisomus gobio* was taken in stations in which sampling extended to 15 ft, but most specimens were taken in less than 4 ft. All specimens of *L. gobio* were taken in shallow-water coral reef habitats (H2, H3), with 94% (of 48 specimens) from H2 habitats (table 9). In Honduras *L. gobio* was taken at only one station, a rich shallow-water fringing reef on Roatan. In Belize *L. gobio* was taken only at Barrier Reef sites (BRG, CBC) or at the atolls (GR, LR). Additional Belize records are from Turneffe Island.

Labrisomus gobio has been taken with all species of *Labrisomus* except *L. albigenys* and *L. kalisherae*. *Labrisomus gobio* and *L. kalisherae* are very similar in appearance but differ in distribution—*L. gobio* has been taken at offshore, coral-rich habitats in Belize and Honduras, *L. kalisherae* is known in Belize only from cays inside the Barrier Reef and in Honduras only from the Hog Islands. *Labrisomus gobio* shared highest affinity (GMI) values with *Labrisomus guppyi* and *Malacoctenus triangulatus* (table 8).

Material examined.—A total of 48 specimens from 10 collections. HONDURAS: IR, 84431 (2). BELIZE: BRG, 77605 (11), 77607 (2); CBC, 89295 (6), 89321 (2), 89380 (8); GR, 77603 (7), 77604 (1); LR, 77602 (4), 86041 (5). Additional Belize material examined: CBC, JWC-8 (1), JWC-11 (1), JWC-16 (5), JWC-19 (1), JWC-23 (3). Additional Belize material reported by Birdsong & Emery 1968: LR, UMML 9561, UMML 9984; TI, UMML 9484, UMML 9836.

(4) **Labrisomus guppyi** (Norman, 1922)

This species is known from the Bahamas, Florida, Greater and Lesser Antilles, Fernando de Noronha (off Brazil), Venezuela, Curacao, and Central America, including Belize, Nicaragua, Panama, and the Yucatan (Springer, 1959a, 1959b; Cervigon, 1966; Birdsong & Emery, 1968; Böhlke & Chaplin, 1968; Mago, 1970; Nagelkerken, 1974). This constitutes the first record for Honduras.

Ecological data.—*Labrisomus guppyi* is the most commonly represented species of *Labrisomus* in our collections from Belize and Honduras. It has been taken in collections in which sampling extended to 20 ft but was most commonly taken in depths of 10 ft or less (24 of 29 collections). Most specimens of *L. guppyi* (86% of 270 specimens) were taken in areas of rich coral (H2, H3), with the remaining specimens (all taken at the Hog Islands) from areas of rocky ledges (H4) or two sites with both rock and coral represented in exceptionally broad stations (field numbers: F75-47, F75-51) and classified as H9 habitats (table 9). In Belize all specimens of *L. guppyi* were taken at the Barrier Reef (BRG, BRT, CBC) or atolls (GR, LR). Additional Belize records include Turneffe Island and one Barrier Reef site (SWC). *Labrisomus guppyi* was taken with every other species of *Labrisomus* represented in our collections but was taken with *L. albigenys* and *L. kalisherae* only at the Hog Islands and with *L. nuchipinnis* only at the Hog Islands and two Barrier Reef sites (BRT, CBC). In cases of co-occurrence *L. guppyi* was virtually always more numerous than any species of *Labrisomus* taken with it (true for 36 of 42 comparisons); four of the six remaining comparisons were ties, and in only two cases (once with *L. bucciferus*, once with *L. gobio*) was *L. guppyi* less numerous than a co-occurring species of *Labrisomus*. *Labrisomus guppyi* shares highest affinity (GMI) values with *Enneanectes boehlkei* and *Ophioblennius atlanticus macclurei* (table 8).

TABLE 9. Distribution of capture records of species of *Labrisomus* with respect to habitat categories. Only those species represented in our collections by 10 or more individuals are included. Data for each species given as number of records (whole numbers) and proportion of total individuals captured (decimal fractions).

Species	N	Habitat category H1	H2	H3	H4	H5	H6	H7	H8	H9
2. *bucciferus*	17	—	4	3	1	1	4	2	—	2
	94	—	.32	.04	.04	.01	.39	.13	—	.06
3. *gobio*	10	—	8	2	—	—	—	—	—	—
	48	—	.94	.06	—	—	—	—	—	—
4. *guppyi*	29	—	16	9	2	—	—	—	—	2
	270	—	.70	.16	.08	—	—	—	—	.06
5. *haitiensis*	18	4	3	9	—	—	—	—	—	2
	70	.20	.07	.56	—	—	—	—	—	.17
6. *kalisherae*	11	—	2	—	4	4	—	—	—	1
	196	—	.02	—	.10	.88	—	—	—	.01
7. *nigricinctus*	13	—	9	1	2	—	1	—	—	—
	41	—	.78	.02	.12	—	.07	—	—	—
8. *nuchipinnis*	16	—	2	—	4	5	2	—	1	2
	71	—	.03	—	.32	.48	.08	—	.06	.03

Material examined.—A total of 270 specimens from 29 collections. HONDURAS: CC, 84461 (4), 84463 (11), 84464 (13), 84465 (2), 84466 (10), 84467 (13), 84468 (7); IR, 84462 (16), 84469 (15). BELIZE: BRG, 70921 (1), 77612 + 86047 (14), 86025 (1); BRT, 86046 (12); CBC, 89286 (14), 89307 (1), 89325 (8), 89330 (4), 89337 (3), 89351 (1), 89385 (3), 89396 (55); GR, 70943 (1), 77606 (6), 77609 (3), 77611 (1), 86045 (28), 86048 (1); LR, 77608 (8), 77610 (14). Additional Belize material examined: CBC, JWC-11(3), JWC-16 (5); LR, UMML 9409, UMML 9501, UMML 9998; TI, UMML 9849, UMML 10319.

(5) **Labrisomus haitiensis** Beebe & Tee Van, 1928

This species is known from the Bahamas, Florida, Greater and Lesser Antilles, Gulf of Mexico (Florida), and Central America, including Lighthouse Reef, Belize, and Banco Chinchorro off Yucatan (Springer, 1959a, 1959b; Birdsong & Emery, 1968; Böhlke & Chaplin, 1968; Smith, 1976). This constitutes the first record for Honduras.

Ecological data.—*Labrisomus haitiensis* has been taken at greater depths than any other species of *Labrisomus* represented in our collections (table 6). It was collected in depths as deep as 50 ft, but most records (12 of 18) and specimens (52 of 70) are from depths less than 20 ft, and six of the 18 collections containing this species were in depths less than 6 ft. We have taken *L. haitiensis* only in coral-rich offshore habitats either patch reefs, shallow fringing reefs, or the top of marked dropoffs (table 9), with the majority of both records and specimens (56% of 70 specimens) from patch reef sites (H3) in the lagoon at Glovers Reef. In Belize *L. haitiensis* was taken only at Barrier Reef sites (BRG, CBC) and the atolls (GR, LR), with the majority of both records (12 of 14) and specimens (49 of 52) from atoll localities. Additional Belize records include Turneffe Island and one Barrier Reef locality (SWC). In Honduras we have taken *L. haitiensis* at the Hog Islands and at Roatan. *Labrisomus haitiensis* has been taken with all species of *Labrisomus* except *L. albigenys*. It was taken with *L. kalisherae* and *L. nuchipinnis* only at one exceptionally broad station (F75-51) at the Hog Islands. *Labrisomus haitiensis* shares highest affinity (GMI) values with *Enneanectes altivelis* and *Malacoctenus boehlkei* (table 8).

Material examined.—A total of 70 specimens from 18 collections. HONDURAS: CC, 84440 (2), 84441 (6); IR, 84438 (2), 84439 (10). BELIZE: BRG, 77810 (1); CBC, 89292 (2); GR, 70988 + 77613 (2), 71100 (2), 71112 (2), 71122 (1), 71123 (2), 71142 (3), 71144 + 86042 (3), 77615 (2), 84553 (5), 86043 (4), 86044 (18); LR, 77614 (3). Additional Belize material examined: LR, UMML 9412 (3), UMML 9492 (2).

(6) **Labrisomus kalisherae** (Jordan, 1904)

This species has been reported from Florida, Tobago, Isla Fernando de Noronha (Brazil), Venezuela, Belize, Nicaragua, Panama, Campeche Banks (Mexico), and Cabo Rojo (Veracruz, Mexico) (Springer, 1959a; Rubinoff & Rubinoff, 1962; Caldwell & Caldwell, 1964; Cervigon, 1966; Birdsong & Emery, 1968; Mago, 1970). This constitutes the first record for Honduras.

Ecological data.—*Labrisomus kalisherae* was taken in stations in which sampling extended to 15 ft, but the majority of both records (eight of 11) and specimens (188 of 196) were taken in less than 5 ft. In Belize *L. kalisherae* was taken only at cays inside the Barrier Reef and in habitats dominated by coarse coral rubble and

extensive algal mats (H5). In Honduras *L. kalisherae* was collected only at the Hog Islands in areas of rocky ledges with or without extensive live coral (H2, H4) and in one exceptionally broad station (F75-51) classified as H9 (table 9). *Labrisomus kalisherae* was taken with all species of *Labrisomus* represented in our collections save the purely insular *L. gobio* (see above), but all records of co-occurrence other than with *L. nuchipinnis* are from localities in the Hog Islands where a number of exceptionally broad collecting stations, including habitats (at a single site) ranging from rock and algae, to coral rubble and sand, to live coral, obscure the possibility of habitat separation among the species collected. *Labrisomus kalisherae* shares highest affinity (GMI) values with *Starksia occidentalis* and *Scartella cristata* (table 8).

Material examined.—A total of 196 specimens from 11 collections. HONDURAS: CC, 84447 (7), 84448 (3), 84449 (2), 84450 (4), 84451 (5), 84452 (2), 84453 (1). BELIZE: BC, 86051 (16); FC, 86050 (22); FC, 86052 (22); TC, 86049 (112).

(7) **Labrisomus nigricinctus** Rivero, 1936

This species is known from the Bahamas, Florida, Greater and Lesser Antilles, Curacao, Los Roques (Venezuela), and Central America, including Courtown Cays off Nicaragua, Panama, and Banco Chinchorro off Yucatan (Springer, 1959a, 1959b; Rubinoff & Rubinoff, 1962; Birdsong & Emery, 1968; Böhlke & Chaplin, 1968; Cervigon, 1968; Nagelkerken, 1974). This constitutes the first record for Belize and for Honduras.

Ecological data.—*Labrisomus nigricinctus* was taken in collections in which sampling extended to 18 ft, but most records (11 of 13) and specimens (36 of 41) are from stations in 6 ft of water or less. Although *L. nigricinctus* was taken in a variety of habitats (table 9), the majority of both records (9 of 13) and specimens (78% of 41) are from rich shallow-water reefs in relatively high wave energy sites (H2). In Belize *L. nigricinctus* was taken only at Barrier Reef sites (BRG, BRT, CBC) and at Glovers Reef. In Honduras *L. nigricinctus* was taken at Roatan and at the Hog Islands. *Labrisomus nigricinctus* was taken with all other species of *Labrisomus* but was taken with *L. kalisherae* only at the Hog Islands. *Labrisomus nigricinctus* shares highest affinity (GMI) values with *Malacoctenus aurolineatus* and *Enneanectes pectoralis* (table 8).

Material examined.—A total of 41 specimens from 13 collections. HONDURAS: CC, 84434 (3), 84436 (1), 84437 (4); IR, 84435 (1). BELIZE: BRG, 77616 (1), 86026 (1), 86055 (1); BRT, 86054 (4); CBC, 89293 (9), 89320 (1), 89379 (1); GR, 77617 (2), 86053 (3).

(8) **Labrisomus nuchipinnis** (Quoy & Gaimard, 1824)

This species is known from both sides of the Atlantic: eastern Atlantic, Madeira Islands to Annobon Island; western Atlantic, Bermuda, the Bahamas, Florida, Greater and Lesser Antilles, Brazil, Venezuela, Curacao, Colombia, Central America, including Belize, Honduras, Nicaragua, and Panama; and Gulf of Mexico, including Mexico and Texas (Fowler, 1944; Springer, 1959a, 1959b; Birdsong & Emery, 1968; Böhlke & Chaplin, 1968; Nagelkerken, 1974). This constitutes the first record for Honduras.

Ecological data.—All of our records for *L. nuchipinnis* are from stations in less than 10 ft of water, and 14 of 16 records are from less than 5 ft. Although *L.*

nuchipinnis was taken in a variety of shallow-water habitats (table 9), the great majority of specimens (80% of 71) came from rocky areas (H4) in the Hog Islands or from coarse coral rubble (H5) at cays at and inside of the Barrier Reef in Belize. One record is from pier pilings at Trujillo. *Labrisomus nuchipinnis* is known from both mainland and insular localities, in Belize from cays inside the Barrier Reef (BC, SC, TC), from Barrier Reef sites (BRT, CBC), and from Glovers Reef; in Honduras from mainland sites (Trujillo) and from the Hog Islands. *Labrisomus nuchipinnis* was taken with all species of *Labrisomus* except *L. albigenys*, but was taken with *L. haitiensis* only at one exceptionally broad (F75-51) station at the Hog Islands. *Labrisomus nuchipinnis* shares highest affinity (GMI) values with *Paraclinus nigripinnis* and *Scartella cristata*.

Material examined.—A total of 71 specimens from 16 collections. HONDURAS: CC, 84455 (4), 84456 (1), 84457 (2), 84458 (3), 84459 (3), 84460 (14); Mainland, pier at Trujillo, 84454 (4). BELIZE: BC, 86060 (4); BRT, 86056 (1); CBC, 89301 (3), 89355 + 89413 (23), 89390 (1); GR, 86057 (3), 86058 (1); SC, 86061 (1); TC, 86059 (3). Additional Belize material examined: SWC, JWC-13 (1), JWC-24 (1).

Malacoctenus Gill, 1860

The genus *Malacoctenus* contains 18 species, one species (*M. africanus* Cadenat) in the eastern Atlantic, eight species in the western Atlantic, and nine species (four of which have two recognized subspecies) in the eastern Pacific. The latest revision of the genus is that of Springer (1959a).

All known western Atlantic species of *Malacoctenus* occur off the Central American coast, and all except *M. versicolor* (Poey) are represented in our collections from Belize and Honduras. *Malacoctenus versicolor*, known from the Bahamas, Florida, Greater and Lesser Antilles, was reported from Belize (UMML 9996 (1), Lighthouse Reef) by Birdsong & Emery (1968). Co-occurrence data for species of *Malacoctenus* is presented in Table 10.

(9) **Malacoctenus aurolineatus** Smith, 1957

This species is known from the Bahamas, Florida, Greater and Lesser Antilles, Venezuela, and Central America, including Yucatan (Springer, 1959a, 1959b; Birdsong & Emery, 1968; Böhlke & Chaplin, 1968; Cervigon, 1968). This constitutes the first record for Belize and for Honduras.

Ecological data.—Malacoctenus aurolineatus has been taken in stations in which sampling extended to 15 ft, but most records (11 of 12) and specimens (171 of 173) are from less than 10 ft, and the majority from less than 6 ft. Except for one specimen taken in a reef-crest pool (H6) at Glovers Reef, all records and specimens of *M. aurolineatus* (table 11) are from shallow, rich reef habitats (H2) in Belize; shallow rocky habitats (H4) in Honduras; or, in the case of one exceptionally broad station (F75-51) in Honduras, both rock and coral (H9). In Belize *M. aurolineatus* was taken only from Barrier Reef sites (BRG, BRT, CBC) and the atolls (GR, LR), with most specimens (27 of 32) from the Barrier Reef. In Honduras *M. aurolineatus* was taken only at the Hog Islands. *Malacoctenus aurolineatus* was taken with all species of *Malacoctenus* (table 10) except *M. boehlkei* (apparently a generally deeper-living species) and *M. delalandei* (most specimens of which were taken at more inshore localities). *Malacoctenus aurolineatus* shares

TABLE 10. Co-occurrence of species of *Malacoctenus*. Values in upper half of matrix (whole numbers) are actual number of records (number of stations) of co-occurrence (based on all stations). Values in the lower half of matrix are calculated GMI values (based on Class I stations only).

Species	N_T	N_I	9	10	11	12	13	14	15
9. *aurolineatus*	12	12	—	0	0	8	5	4	10
10. *boehlkei*	12	12	0	—	0	0	0	2	1
11. *delalandei*	4	4	0	0	—	0	2	2	2
12. *erdmani*	9	9	.62	0	0	—	5	5	8
13. *gilli*	21	21	.21	0	.11	.26	—	8	9
14. *macropus*	21	21	.14	.02	.11	.26	.27	—	10
15. *triangulatus*	32	31	.43	0	.09	.39	.26	.30	—

Listing of species sharing highest GMI values with species of *Malacoctenus* (five highest values only).

9. *aurolineatus*	12 (.62), 7 (.58), 51 (.53), 37 (.47), 4 (.44)
10. *boehlkei*	5 (.30), 20 (.26), 43 (.25), 25 (.20), 50 (.19)
11. *delalandei*	21 (.27), 8 (.25), 55 (.18), 6 (.15), 32 (.14)
12. *erdmani*	9 (.62), 57 (.46), 7 (.42), 49 (.41), 37 (.41)
13. *gilli*	2 (.60), 8 (.49), 51 (.43), 21 (.42), 6 (.29)
14. *macropus*	21 (.42), 6 (.35), 8 (.33), 57 (.30), 15 (.30)
15. *triangulatus*	4 (.61), 35 (.58), 55 (.57), 37 (.51), 27 (.49)

N_T = total number of stations; N_I = number of Class I stations.

highest affinity (GMI) values with *Malacoctenus erdmani* and *Labrisomus nigricinctus*.

Material examined.—A total of 173 specimens from 12 collections. HONDURAS: CC, 84406 (29), 84407 (20), 84408 (44), 84486 (6). BELIZE: BRG, 77626 (1), 77633 + 86068 (2); BRT, 85987 (15); CBC, 89283 (28), 89378 (22); GR, 85988 (1), 85989 (2); LR, 77621 (3).

(10) **Malacoctenus boehlkei** Springer, 1959

This species has been reported from the Bahamas, Virgin Islands, Albuquerque Cays off Nicaragua, and Belize (Springer, 1959a, 1959b; Birdsong & Emery, 1968; Böhlke & Chaplin, 1968). This constitutes the first record for Honduras.

Ecological data.—*Malacoctenus boehlkei* is the deepest-living species of *Malacoctenus* represented in our material. Our depth records for this species include stations at 90 to 100 ft, and six of the 12 stations at which this species was taken were in depths exceeding 50 ft; however, most specimens of this species (39 of 57, from five collections) were taken at depths of 15 ft or less. Two habitats, fore-reef dropoff areas (H1) and patch reefs (H3), accounted for virtually all (98% of 57 specimens) material of *M. boehlkei* (table 11). In Belize this species was taken at the Barrier Reef (CBC) and the atolls (GR, LR) and has been reported from Turneffe Island. One apparently anomalous record (G74-13, one specimen) is from Frenchman's Cay, inside the Barrier Reef, in an area of coarse coral rubble and sand (H5). In Honduras we have only one record of this species, seven specimens taken in 50 ft (F75-48) at the Hog Islands. Examination of co-occurrence data (table 10) suggests that *M. boehlkei* exhibits little habitat overlap with other species of *Malacoctenus*. *Malacoctenus boehlkei* was taken with *M. macropus* on two occasions, both stations on patch reefs in the lagoon of Glovers Reef. *Malacoctenus boehlkei* was taken with *M. triangulatus* only at the apparently

TABLE 11. Distribution of capture records of species of *Malacoctenus* with respect to habitat categories. Data for each species given as number of records (whole numbers) and proportion of total individuals captured (decimal fractions).

Species	N	Habitat category H1	H2	H3	H4	H5	H6	H7	H8	H9
9. *aurolineatus*	12	—	7	—	3	—	1	—	—	1
	173	—	.42	—	.46	—	.01	—	—	.12
10. *boehlkei*	12	7	—	4	—	1	—	—	—	—
	57	.32	—	.67	—	.02	—	—	—	—
11. *delalandei*	4	—	—	—	—	2	—	1	1	—
	22	—	—	—	—	.41	—	.05	.55	—
12. *erdmani*	9	—	4	—	4	—	—	—	—	1
	40	—	.45	—	.50	—	—	—	—	.05
13. *gilli*	21	—	5	1	3	4	5	2	—	1
	154	—	.06	.01	.18	.06	.37	.32	—	.01
14. *macropus*	21	—	3	4	3	2	1	4	—	4
	166	—	.04	.05	.42	.14	.17	.06	—	.13
15. *triangulatus*	32	1	12	7	4	3	—	2	—	3
	254	.01	.37	.12	.28	.02	—	.01	—	.19

anomalous (for *M. boehlkei*) station at Frenchman's Cay. *Malacoctenus boehlkei* shares largest affinity (GMI) values with *Labrisomus haitiensis*, *Paraclinus marmoratus* (a species taken at only two stations), and *Emblemaria caldwelli* (table 11).

Material examined.—A total of 57 specimens from 12 collections. HONDURAS: CC, 84405 (7). BELIZE: CBC, 89311 (1); FC, 86023 (1); GR, 71084 (1), 71128 (1), 71133 (1), 71138 (1), 85981 (22), 85982 (6), 85983 + 89404 (3), 86164 (12); LR, 77622 (1). Additional Belize material examined: TI, UMML 9865 (1).

(11) **Malacoctenus delalandei** (Valenciennes, 1836)

This species has been reported from Puerto Rico, Tobago, Natal (Brazil), Venezuela, Panama, Guatemala, and Belize (Springer, 1959a; Birdsong & Emery, 1968). This constitutes the first record for Honduras.

Ecological data.—*Malacoctenus delalandei* was taken by us on only four occasions, twice in Belize and twice in Honduras. The Belize records are from cays inside the Barrier Reef (BC, TC) in waters less than 4 ft, over coral rubble and algae (H5). Additional Belize records are from the mainland. In Honduras, *M. delalandei* was collected at Roatan in less than 5 ft of water, in an area of sand and *Thalassia* adjacent to a pier (H7), and was collected on pier pilings at Trujillo in less than 5 ft of water (H8). *Malacoctenus delalandei* is apparently absent in areas of rich coral development. *Malacoctenus delalandei* was taken with *M. gilli* (IR, BC), *M. macropus* (IR, TC), and *M. triangulatus* (IR, BC) (table 10). *Malacoctenus delalandei* shares highest affinity (GMI) values with *Paraclinus nigripinnis* and *Labrisomus nuchipinnis*.

Material examined.—A total of 22 specimens from four collections. HONDURAS: IR, 84403 (1); Mainland, pier at Trujillo, 84404 (12). BELIZE: BC, 85984 (2); TC, 85985 (7). Additional Belize material examined: Mainland, 1.5 miles south-southwest of Belize City, UMML 9609; 2.5 miles north of Belize City at southeast corner of Peter's Bluff, UMML 9787.

(12) **Malacoctenus erdmani** Smith, 1957

This species is known from the Bahamas, Greater and Lesser Antilles, and Central America, including Lighthouse Reef off Belize, Albuquerque Cays off Nicaragua, and Banco Chinchorro off Yucatan (Springer, 1959a, 1959b; Birdsong & Emery, 1968; Böhlke & Chaplin, 1968). This constitutes the first record for Honduras.

Ecological data.—All of our records for this species were from 10 ft of water or less, and most records (seven of nine) and specimens (37 of 40) were from stations in 6 ft of water or less. All specimens were taken in either rich reef formations in shallow water (H2, all Belize records) or in areas of rocky ledges (H4, Honduras records) except for one record from an exceptionally broad station (F75-51) at the Hog Islands that included both rock formations and rich coral formations (H9; see table 11). In Belize *M. erdmani* was taken only at Barrier Reef sites (BRG, BRT, CBC) and was never taken at Glovers Reef or Lighthouse Reef. Additional Belize material includes one specimen from Turneffe Island. Because we have taken *M. erdmani* on only four occasions in Belize, the apparent absence of this species at the offshore atolls (GR, LR) may well reflect inadequacies in sampling effort. In Honduras *M. erdmani* was taken only at the Hog Islands.

Malacoctenus erdmani was taken with all species of *Malacoctenus* except *M. boehlkei* and *M. delalandei*. *Malacoctenus erdmani* shares highest affinity (GMI) values with *Malacoctenus aurolineatus* and *Scartella cristata*.

Material examined.—A total of 40 specimens from nine collections. HONDURAS: CC, 84409 (1), 84410 (2), 84411 (9), 84412 (8), 84484 (2). BELIZE: BRG, 77625 (1), 89411 (1); BRT, 85990 (14); CBC, 89285 (2). Additional Belize material examined: LR, UMML 9467 (1).

(13) **Malacoctenus gilli** (Steindachner, 1867)

This species is known from the Bahamas, Greater and Lesser Antilles, Venezuela, Curacao, Gulf of Mexico off Tampico (Mexico), and Central America, including Belize, Honduras, Nicaragua, and Yucatan (Springer, 1959a, 1959b; Cervigon, 1966; Birdsong & Emery, 1968; Böhlke & Chaplin, 1968; Mago, 1970; Nagelkerken, 1974).

Ecological data.—All specimens of *Malacoctenus gilli* were taken in less than 5 ft of water. *Malacoctenus gilli* was taken in a wide variety of habitat categories (table 11), but two categories, H6, reef crest pools, and H7, sea grass beds, together accounted for 69% of the 154 specimens of *M. gilli* represented in our collections. Habitat categories H6 and H7 were represented by only seven stations and five stations, respectively, of the 127 total. In Belize *M. gilli* was taken at cays inside the Barrier Reef (BC, SC), at Barrier Reef sites (BRT, CBC), and at the atolls (GR, LR). Additional records from Belize include Turneffe Island and two Barrier Reef sites (CBC, SWC). Records from Honduras are from the Hog Islands and from Roatan. *Malacoctenus gilli* has been taken with all species of *Malacoctenus* represented in our collections except *M. boehlkei*, from which it apparently differs substantially in both depth distribution and habitat preference (see above). *Malacoctenus gilli* shares highest affinity (GMI) values with *Labrisomus bucciferus* and *Labrisomus nuchipinnis* (table 10).

Material examined.—A total of 156 specimens from 23 collections. HONDURAS: CC, 84413 (5), 84416 (16), 84417 (2), 84418 (2), 84485 (20); IR, 39843 (1), 84414 (33), 84415 (16). BELIZE: BC, 85991 (4); BRT, 85996 (2); CBC, 89297 (3), 89300 (1), 89309 (1), 89354 (3); GR, 39822 (1), 71110 (9), 71124 (4), 77623 (1), 85992 (25), 85993 (1), 85994 (3); LR, 77624 (1); SC, 85995 (2). Additional Belize material examined: CBC, JWC-12 (1), JWC-16 (1), JWC-21 (1); SWC, JWC-19 (4), JWC-20 (5), JWC-24 (2), JWC-25 (1); TI, UMML 9860.

(14) **Malacoctenus macropus** (Poey, 1868)

This species is known from Bermuda, the Bahamas, Florida, Greater and Lesser Antilles, Venezuela, and Central America, including Belize, Nicaragua, Panama, and Yucatan (Springer, 1959a; Caldwell & Caldwell, 1964; Birdsong & Emery, 1968; Böhlke & Chaplin, 1968; Cervigon, 1968). This constitutes the first record for Honduras.

Ecological data.—*Malacoctenus macropus* was taken in collections in which sampling extended to 15 ft, but most records (17 of 21) and specimens (142 of 166) are from less than 6 ft. *Malacoctenus macropus* was taken in a wide variety of shallow-water habitats (table 11). The geographic extent of localities at which this species was represented was also broad, excluding only mainland sites. In

Belize this species was taken at cays inside of the Barrier Reef (SC, TC), at Barrier Reef sites (BRT; with additional records from CBC and SWC), and the atolls (GR, LR, with an additional record from TI). In Honduras *M. macropus* was taken at the Hog Islands and at Roatan. *Malacoctenus macropus* was taken with every other species of *Malacoctenus* represented in our collections. *Malacoctenus macropus* shares highest affinity (GMI) values with *Paraclinus nigripinnis* and *Labrisomus kalisherae* (table 10).

Material examined.—A total of 166 specimens from 21 collections. HONDURAS: CC, 84420 (28), 84421 (1), 84422 (5), 84423 (14), 84424 (49), 84428 (15); IR, 84419 (2), 84425 (2), 84426 (2), 84427 (6), 84429 (1), 84430 (3). BELIZE: BRT, 86002 (4); GR, 71129 + 86001 (3), 77618 (1), 77619 (2), 77620 (1), 86004 (3), 86006 (1); SC, 86003 (8); TC, 86005 (16). Additional Belize material examined: CBC, JWC-3 (2), JWC-12 (25); LR, UMML 9986; SWC, JWC-9 (4), JWC-13 (8), JWC-20 (2), JWC-25 (1); TI, UMML 9800.

(15) **Malacoctenus triangulatus** Springer, 1959

This species is known from the Bahamas, Florida, Greater and Lesser Antilles, Fernando de Noronha (Brazil), Venezuela, Curacao, Colombia, Central America, including Belize, Nicaragua, Panama, and Yucatan, and Gulf of Mexico at Cabo Roja, Veracruz (Springer, 1959a, 1959b; Birdsong & Emery, 1968; Böhlke & Chaplin, 1968; Nagelkerken, 1974; Springer & Gomon, 1975). This constitutes the first record for Honduras.

Ecological data.—*Malacoctenus triangulatus* is represented in our collections at more stations than any other blennioid species. It is represented by more specimens than any other species except *Labrisomus guppyi, Entomacrodus nigricans,* and *Ophioblennius atlanticus macclurei. Malacoctenus triangulatus* was taken at one station (F75-15) in which sampling was conducted between 45 and 60 ft. All other records are from less than 20 ft, and most records (27 of 32) and specimens (211 of 254) are from stations in less than 10 ft of water. *Malacoctenus triangulatus* was taken in a wide variety of habitats (table 11), but the majority of records (25 of 32) and specimens (95% of 254) are from rich shallow-water fringing reefs or patch reefs (H2, H3), areas of rocky ledges (H4), or from two exceptionally broad Hog Island stations (F75-47, F75-51) with both rock and coral formations present (H9). The geographic extent of localities at which *M. triangulatus* was taken is equally broad, excluding only the mainland stations. In Belize *M. triangulatus* was taken at cays behind the Barrier Reef (BC, FC, SC), Barrier Reef sites (BRG, CBC, with additional records from SWC), and the atolls (GR, LR, with additional records from Turneffe Island). Very few records (three of 18) and specimens (four of 85) are from cays inside of the Barrier Reef. In Honduras *M. triangulatus* was taken at Roatan and the Hog Islands. *Malacoctenus triangulatus* was taken with all other species of *Malacoctenus* represented in our collections. *Malacoctenus triangulatus* shares highest affinity (GMI) values with *Labrisomus guppyi* and *Enneanectes boehlkei.*

Material examined.—A total of 254 specimens from 32 collections. HONDURAS: CC, 84391 (18), 84392 (37), 84393 (30), 84394 (10), 84395 (1), 84397 (20), 84398 (1), 84399 (13), 84487 (3); IR, 84390 (18), 84396 (2), 84400 (11), 84401 (3), 84402 (2). BELIZE: BC, 85999 (2); BRB, 86000 (1); BRG, 70922 (1), 86065 (15); CBC, 89299 (16), 89319 (9), 89331 (1), 89338 (2), 89366 (4), 89392 (1); FC, 85998 (1); GR,

85997 (2), 86062 (16), 86063 (1), 86064 (1); LR, 86066 (1), 86067 (10); SC, 86024 (1). Additional Belize material examined: LR, UMML 9268, UMML 9543; SWC, JWC-24 (2); TI, UMML 9472, UMML 9824, UMML 10314.

Paraclinus Macquard, 1889

The genus *Paraclinus* contains 19 species, eight in the western Atlantic and 11 in the eastern Pacific. The latest revision of eastern Pacific species is that of Rosenblatt & Parr (1969), and the latest revision of western Atlantic species, that of Springer (1955a). Two additional western Atlantic species were described by Böhlke (1960).

Six of the eight known western Atlantic species of *Paraclinus* occur off the Central American coast. Only *P. grandicomis* (Rosen) [known from the Bahamas, Florida, and south through the Lesser Antilles (Böhlke & Chaplin, 1968)] and *P. naeorhegmis* Böhlke (known only from the Bahamas) are not represented in our collections from Belize and Honduras. Co-occurrence data for species of *Paraclinus* is presented in Table 12.

(16) **Paraclinus barbatus** Springer, 1955

This species has been reported from the Bahamas, Virgin Islands, and Santa Marta, Colombia (Springer, 1955a; Böhlke & Chaplin, 1968; Palacio, 1974). The specimens listed below are the first documented record for Belize and represent a significant range extension for the species.

Paraclinus barbatus was described by Springer (1955a) from a single (28.3 mm SL) specimen collected at St. Thomas, Virgin Islands, in 1919. Böhlke & Chaplin (1968) record a second specimen taken in the Bahamas in 1966 and present an illustration of the Bahaman specimen. A third specimen (UMML 30301) is reported by Palacio (1974) from Colombia. The two specimens recorded below from Belize thus represent the fourth and fifth known specimens of *P. barbatus*.

TABLE 12. Co-occurrence of species of *Paraclinus*. Values in upper half of matrix (whole numbers) are actual number of records (number of stations) of co-occurrence (based on all stations). Values in the lower half of the matrix are calculated GMI values (based on Class I stations only).

Species	N_T	N_I	Co-occurring species 16	17	18	19	20	21
16. *barbatus*	1	1	—	0	0	0	0	0
17. *cingulatus*	1	1	0	—	0	0	0	1
18. *fasciatus*	5	5	0	0	—	0	0	3
19. *infrons*	6	6	0	0	0	—	0	0
20. *marmoratus*	2	2	0	0	0	0	—	0
21. *nigripinnis*	14	14	0	.13	.22	0	0	—

Listing of species sharing highest GMI values with species of *Paraclinus* (five highest values only).

16. *barbatus* 10 (.14), 34 (.12), 26 (.11), 50 (.10), —
17. *cingulatus* 31 (.50), 49 (.29), 47 (.25), 53 (.22), 57 (.19)
18. *fasciatus* 21 (.22), 2 (.21), 14 (.18), 13 (.18), —
19. *infrons* 43 (.41), 50 (.40), 26 (.34), 48 (.20), 34 (.18)
20. *marmoratus* 10 (.26), 14 (.20), 32 (.06), 39 (.05), 2 (.05)
21. *nigripinnis* 8 (.54), 27 (.44), 6 (.43), 14 (.42), 13 (.42)

N_T = total number of stations; N_I = number of Class I stations.

These two specimens [FMNH 71085, original field number G 70-127, 2 (39.1 to 46.0)] were collected at Glovers Reef in December, 1970, at a depth of 70 to 100 ft. Five additional specimens were taken at Glovers Reef in June, 1971, at depths of 60 to 100 ft (original field number G 71-25), but the preservative used failed, and the material was lost. In the following paragraphs we present a description of the two Belize specimens.

Meristic characters.—In the following listing values for the two Belize specimens (39.1, 46.0), Palacio's (1974) (31 mm) specimen, and the holotype (28.3 mm, Springer, 1955a) are given in that order. Dorsal-fin elements: XXIX, 1; XXIX, 1; XXVIII, 1; XXVIII, 1. Anal-fin elements: II, 19; II, 20; II, 19; II, 19. Pectoral-fin rays: 13 (all). Pelvic-fin elements: I, 3 (all). Branchiostegal rays: 6 (all). Caudal-fin rays: 13, 13, 12, 12. Lateral line scales: —, —, 37, 37 (the number of lateral line scales could not be determined in the Belize specimens).

Morphometric characters.—The following morphometric characters, measured according to the methods of Springer (1955a), are listed as thousandths of the SL and are based on the 46.0-mm Belize specimen and the 28.3-mm holotype [values in parentheses, data from Springer (1955a)]. Unfortunately, the 39.1-mm Belize specimen was deformed during preservation, and values of morphometric characters are not presented for this specimen. Tip of snout to tip of opercular spine, 274 (297). Tip of snout to anterior bony margin of orbit, 76 (78). Horizontal bony diameter of orbit, 83 (88). Interorbital width, 48 (49). Tip of snout to greatest expansion of maxillary, 130 (141). Tip of snout to dorsal-fin origin, 207 (212). Tip of lower jaw to anal-fin origin, 513 (495). Preopercular length, 54 (67). Distance from pelvic-fin insertion to anal-fin origin, 309 (283). Length of first dorsal-fin spine, 85 (92). Length of second dorsal-fin spine, 91 (106). Length of third dorsal-fin spine, 87 (106). Length of fourth dorsal-fin spine, 87 (106). Length of 22nd dorsal-fin spine, 143 (148). Length of penultimate dorsal-fin spine, 120 (117). Length of last dorsal-fin spine, 98 (106). Distance between base of third and base of fourth dorsal-fin spines, 70 (78). Length of dorsal-fin base, 837 (777). Length of anal-fin base, 483 (495). Length of first anal-fin spine, 70 (71). Length of second anal-fin spine, 89 (106). Longest pectoral-fin ray, 276 (247). Length of longest pelvic-fin ray, 243 (247). Least depth of caudal peduncle, 98 (88). Greatest depth of body, 302 (276).

Description.—The following abbreviated description is based on the two Belize specimens. A fleshy barbel extending ventrally from tips of lower jaw, length of barbel slightly exceeding horizontal diameter of eye. Lips thick and fleshy. Nasal cirrus simple and filamentous. Supraorbital and nuchal cirri paddle-shaped with shallow crescent-shaped lobes on distal margin. A strongly developed but simple opercular spine extending posterior to a vertical through base of third dorsal-fin spine. Lateral line scales apparently arranged as figured and described by Springer (1955a) for holotype, but an accurate lateral line scale count cannot be obtained for the two Belize specimens due to damage to the specimens.

Color in alcohol.—Body uniformly tan. Head with dark brown blotches of pigment on snout, over ventral and posterior infraorbital bones, on cheek, and over preopercle. Barbel and nasal cirri lacking pigment, but a dark blotch of pigment present distally on supraorbital and nuchal cirri. Three dark, irregular brown bars present on each pectoral and pelvic fin, and four dark brown bars present

on caudal fin (the middle two bars set closely together). Dorsal fin lacking pigment except for three very prominent dark ocelli, each subequal in size to eye diameter. Dorsal ocelli appearing over 16th (15th) to 18th, 22nd to 24th, and 28th to 29th dorsal-fin spines. Anal fin with dense dark brown pigmentation over rays and membranes except for distal ca. 20% of length of anal-fin rays, which are clear.

Color in life.—The first description of coloration in freshly captured specimens follows. Body burnt-orange red, a white blotch running posteroventrally from pectoral axil to ventral surface. Head darker, grading into purple-red anteriorly. White blotch on posteroventral edge of opercle, running across branchiostegal membrane onto ventral surface of body. A purple-red bar running from ventral edge of orbit to isthmus, with areas anterior and posterior to bar white. Interorbital, snout, upper and lower lips purple-red, appearing as a bar running anteroventrally from orbit. Iris of eye red-orange with several black lines radiating from black pupil. Pectoral and pelvic fins banded with alternating black and yellow bars. Dorsal fin colored as body on basal two-thirds, distal one-third white, with occasional scattered white blotches on dorsal membranes. Posterior half of dorsal with three black ocelli, surrounded by concentric yellow and dark red rings. Basal one-half of anal fin black, distal one-half white, ends of anal-fin rays light brown to black. Basal portion of caudal fin white, followed by a narrow, vertical band, posterior three-fourths of caudal fin with three indistinct black vertical bars (lighter than first band), distal portion of caudal fin white.

Ecological data.—*Paraclinus barbatus* has been taken by us on only two occasions, only at Glovers Reef, in depths exceeding 60 ft, in areas of rich coral development in the reef-front dropoff zone (H1). This species was not taken with any other species of *Paraclinus*.

Material examined.—Two specimens from one collection. BELIZE: GR, 71085 (2).

(17) **Paraclinus cingulatus** (Evermann & Marsh, 1900)

This species has been reported from the Tortugas, the Bahamas, Cuba, and Puerto Rico (Springer, 1955a; Böhlke & Chaplin, 1968). This constitutes the first record for Honduras and a significant range extension for the species.

The single (17.0 mm) specimen of *P. cingulatus* represented in our material was taken 21 May 1975 (original field number FMNH 75-51) in less than 10 ft of water on the west side of Big Hog Island, Honduras. The specimen was collected in an area of rock, coral rubble, and sand inshore, with small but rich reef formations further offshore. Twenty-three specimens of *P. nigripinnis* were taken at the same station. The specimen agrees very well with the description of *P. cingulatus* provided by Springer (1955a, p 437). The following counts are based on the Honduras specimen: dorsal-fin elements, XXVII, 0. Anal-fin elements, II, 15. Pectoral-fin rays, 12. Pelvic-fin elements, I, 2. Caudal-fin rays, 13. Branchiostegal rays, 6. Lateral line scales, 30.

Color in life.—Taken from a 35-mm Kodachrome. Body orange, crossed by four black bars. First bar runs from anus onto first three spines posterior to notch in the dorsal fin, where it becomes reddish brown; anterior to this bar, body white below midline and orange above. Second bar extends from first four elements of

anal fin up onto basal half of dorsal fin, retaining its black color. Third bar runs from sixth through eighth anal elements up onto dorsal fin and nearly to its margin; here it merges with uppermost portion of second bar. Fourth bar well separated from and less intense in color than other three, extending from last five elements of anal fin up onto last seven elements of dorsal fin, where it becomes reddish brown in color. Spines of first portion of dorsal fin orange, crossed by two or three black bands; second portion of dorsal fin orange, margined with white, and crossed by bars of the body. First half of anal fin black, except for small orange patch at base of elements between second and third body bars; posterior half orange, grading posteriorly into brown and then black; entire margin of anal fin clear and expanded posteriorly to include distal halves of last four elements and membranes between them. Orange color of body ends abruptly at caudal-fin peduncle, with white fin base bordered posteriorly by dark brown line; fin rays also white, crossed with five or six brown bars and membranes between them clear. Pectoral fins white with scattered brown bars on rays similar to those on caudal fin. Pelvic fin black basally and white distally. Head mottled with black and rose, prominent black bar running from lower margin of eye posteriorly along upper jaw to behind maxillary; lips, maxillary, and iris rose; opercular membranes orange.

Material examined.—One specimen from one collection. HONDURAS: CC, 84480 (1).

(18) **Paraclinus fasciatus** (Steindachner, 1876)

This species is known from the Bahamas, Florida, Greater and Lesser Antilles, Venezuela, Colombia, and Central America, including Belize, Guatemala, and Panama (Springer, 1955a; Birdsong & Emery, 1968; Böhlke & Chaplin, 1968). This constitutes the first record for Honduras.

Ecological data.—We have taken *P. fasciatus* on only five occasions, always in less than 4 ft of water. All five stations were in or adjacent to sea grass beds, with 22 of the 27 total specimens (table 13) from two very shallow stations in extensive sea grass beds at Port Royal, Roatan. In no case was *P. fasciatus* taken in or near extensive live coral. The Belize collections containing this species were both mainland sites (Placentia and near Belize City). In Honduras *P. fasciatus* was taken at Roatan and the Hog Islands. In Belize *P. fasciatus* was taken with no other blennioid species. In Honduras *P. fasciatus* was taken with *Labrisomus bucciferus, Malacoctenus gilli, M. macropus,* and *Paraclinus nigripinnis* in all three collections in which *P. fasciatus* was represented.

Material examined.—A total of 27 specimens from five collections. HONDURAS: CC, 84483 (1); IR, 84481 (5), 84482 (17). BELIZE: P, 86030 (3); mainland, beach at St. John's College near Belize City, 86029 (1). Additional Belize material examined: mainland, 2.4 km south-southwest of Belize City, UMML 9607.

(19) **Paraclinus infrons** Böhlke, 1960

This species has previously been reported only from the Bahamas (Böhlke, 1960; Böhlke & Chaplin, 1968). This constitutes the first record for Belize and a significant range extension for the species. *Paraclinus infrons* was described from four (12.6 to 18.8) specimens, all from or from near Grand Bahama Island. Böhlke & Chaplin (1968) mention but do not list additional material from Grand

TABLE 13. Distribution of capture records of species of *Paraclinus, Starksia,* and *Stathmonotus* with respect to habitat categories. Only those species represented in our collection by 10 or more individuals are included. Data for each species given as number of records (whole numbers) and proportion of total individuals captured (decimal fractions).

Species	N	Habitat category H1	H2	H3	H4	H5	H6	H7	H8	H9
18. *P. fasciatus*	5	—	—	—	—	—	1	2	2	—
	27	—	—	—	—	—	.04	.81	.15	—
21. *P. nigripinnis*	14	—	2	—	3	3	2	2	—	2
	121	—	.02	—	.21	.28	.21	.03	—	.25
22. *S. atlantica*	22	2	8	11	—	—	—	—	—	1
	70	.03	.43	.53	—	—	—	—	—	.01
25. *S. lepicoelia*	24	14	5	3	—	—	—	—	—	2
	103	.76	.17	.04	—	—	—	—	—	.03
26. *S. nanodes*	20	16	1	3	—	—	—	—	—	—
	57	.79	.12	.09	—	—	—	—	—	—
27. *S. occidentalis*	14	1	5	—	3	4	—	—	—	1
	53	.11	.28	—	.32	.11	—	—	—	.17
32. *S. stahli tekla*	13	—	4	3	1	2	2	—	—	1
	45	—	.24	.22	.11	.13	.09	—	—	.20

Bahama Bank. Our material of *P. infrons*, seven (13.4 to 21.4) specimens from six collections, was collected either at Glovers Reef (three collections, four specimens) between 50 and 90 ft, near the top of the dropoff for each site, or the Barrier Reef at Carrie Bow Cay (three collections, three specimens) between 70 and 80 ft (in each case) in the dropoff zone. All six sites were areas of rich coral development (H1). *Paraclinus infrons* was taken with no other species of *Paraclinus* (table 12) and, with *Paraclinus barbatus*, is the deepest-living species of *Paraclinus* represented in our collections. *Paraclinus infrons* shares highest affinity (GMI) values with *Emblemaria caldwelli* and *Lucayablennius zingaro*. We present (table 14) meristic and morphometric data for the Belize material.

Material examined.—A total of seven specimens from six collections. BELIZE: CBC, 89332 (1), 89359 (1), 89414 (1); GR, 71116 (1), 86031 (1), 86032 (2).

TABLE 14. Meristic and morphometric data for *Paraclinus infrons* from Belize.

Character	Carrie Bow Cay	Glovers Reef	Bahamas*
Number of specimens	3	4	4
Range in SL (mm)	13.4-21.0	16.0-21.4	12.6-18.8
Spinous dorsal	26-27	27-28	26-27
Soft dorsal	1 (all)	1 (all)	1 (all)
Anal, II +	18 (all)	18 (all)	17-18
Pectoral	12 (all)	12 (all)	12 (all)
Pelvic	I,3 (all)	I,3 (all)	I,3 (all)
Caudal	13 (all)	13 (all)	12-13
Body depth at dorsal origin	224-233	219-221	213-231
Body depth at anal origin	216-243	231-243	214-227
Caudal peduncle depth	104-114	94-103	98-110
First dorsal-fin spine length	210-224	187**	178-194
Third dorsal-fin spine length	67-71	65**	—
Pectoral-fin length	306-310	257-300	284-294
Pelvic-fin length	305-313	300-319	317-339
Head length	376-396	336-388	372-405
Horizontal eye diameter	104-105	85-94	85-95
Upper jaw length	157-162	150-156	154-167
Snout length	105-112	103-112	110-119

All measurements expressed as thousandths of the SL. Morphometric data based on two (89414, 13.4; 89359, 21.0) specimens from Carrie Bow Cay and three (71116, 19.0; 86031, 21.4; 86032, 16.0) specimens from Glovers Reef.

*Data from Böhlke (1960).

**Based on one specimen (86031, 21.4).

(20) **Paraclinus marmoratus** (Steindachner, 1876)

This species has been reported from the Bahamas, Florida, Cuba, and Venezuela (Springer, 1955a; Böhlke & Chaplin, 1968, Cervigon, 1968). This constitutes the first record for Belize and a significant range extension for the species.

Springer (1955a) based his description of *P. marmoratus* on 157 (22.5 to 63) specimens, all but one from Florida. Böhlke & Chaplin (1968) report three specimens from the Bahamas, two of which were said to have been captured on small patch reefs in 17 to 19 ft of water. The two Belize specimens were collected on

small patch reefs in the lagoon near Long Cay, Glovers Reef, in less than 15 ft of water (H3). No other species of *Paraclinus* was represented in these two collections. In general the Belize specimens agree well with Springer's (1955a) description of *P. marmoratus*. We present values for meristic characters for the two Belize specimens (FMNH 86027, 29.1 mm; FMNH 86028, 24.8 mm) listed in that order: dorsal-fin elements, XXVIII, 1; XXVIII, 1; anal-fin elements, II, 16 (correct as given but a noticeable gap between the bases of the 14th and 15th anal-fin rays suggests that the abnormally low count is due to injury or teratology); II, 19; pectoral-fin rays, 13 (both); pelvic-fin elements, I, 3 (both); caudal-fin rays, 13 (both); lateral line scales, ? 35, ? 34.

Material examined.—Two specimens from two collections. BELIZE: GR, 86027 (1), 86028 (1).

(21) **Paraclinus nigripinnis** (Steindachner, 1867)

This species is known from Bermuda, the Bahamas, Florida, Greater and Lesser Antilles, Brazil, Venezuela, and Central America, including Belize, Costa Rica, and Nicaragua (Springer, 1955a; Caldwell, 1963; Birdsong & Emery, 1968; Böhlke & Chaplin, 1968). This constitutes the first record for Honduras.

Ecological data.—All stations at which this species was taken were in less than 10 ft of water, and the majority of both records (10 of 14) and specimens (70 of 121) are from less than 4 ft. *Paraclinus nigripinnis* was taken in a variety of habitats (table 13), but the majority of both records (8 of 14) and specimens (70% of 121) were from shallow rocky sites at the Hog Islands (H4), coarse coral rubble and algae at cays inside the Barrier Reef (H5), or very shallow intertidal (or barely subtidal) reef crest pools at the Hog Islands or Glovers Reef (H6). In Belize this species was taken at cays inside the Barrier Reef (BC, SC, TC) and at the atolls (GR, LR). Additional records for Belize include one mainland site near Belize City, one Barrier Reef site (CBC), and Turneffe Island. In Honduras *P. nigripinnis* was taken at Roatan and the Hog Islands. *Paraclinus nigripinnis* was taken with *P. cingulatus* (only at the Hog Islands) and *P. fasciatus* (only at the Hog Islands and Roatan). *Paraclinus nigripinnis* shares highest affinity (GMI) values with *Labrisomus nuchipinnis* and *Starksia occidentalis* (table 12).

Material examined.—A total of 121 specimens from 14 collections. HONDURAS: CC, 84472 (23), 84474 (16), 84477 (6), 84478 (4), 84479 (2); IR, 84473 (1), 84475 (1), 84476 (3). BELIZE: BC, 86038 (6); GR, 86034 (7), 86035 (23); LR, 86033 (1); SC, 86037 (6); TC, 86036 (22). Additional Belize material examined: CBC, JWC-23 (1); LR, UMML 9980; TI, UMML 9862; mainland, 2.4 km south-southwest of Belize City, UMML 9606.

Starksia Jordan & Evermann, 1896

The genus *Starksia* contains 24 described species, 15 from the western Atlantic and nine from the eastern Pacific. The eastern Pacific species were revised by Rosenblatt & Taylor (1971). Reviews of the Atlantic species may be found in Böhlke & Springer (1961), Gilbert (1965, 1971), and Greenfield (1978).

Eight of the 15 Atlantic species of *Starksia* are represented in our material from Belize and Honduras. Six Atlantic species do not occur or are not known to occur in the western Caribbean: *S. brasiliensis* (south Brasil), *S. culebra* (Haiti, Puerto

Rico, and the lesser Antilles south to and including St. Vincent), *S. fasciata* (Bahamas, Cuba, Antigua, Dominica), *S. guttata* (Tobago Cays and Grenadines south to Trinidad and west to Curacao), *S. ocellata* (both coasts of Florida and north to North Carolina, questionably from the Bahamas), *S. variabilis* (known only from Santa Marta, Colombia). *Starksia y-lineata* is known from Grand Cayman Island and Courtown Cays off Nicaragua. Therefore, nine of the 15 described western Atlantic species of *Starksia* occur off the Central American coast. Co-occurrence data for species of *Starksia* is presented in Table 15.

(22) **Starksia atlantica** Longley, 1934

This species has been reported from the Bahamas, Haiti, Antigua, Venezuela, Curacao, Old Providence Island, Lighthouse Reef and Turneffe Island (Belize), Courtown Cays off Nicaragua, and Yucatan (Böhlke & Springer, 1961; Birdsong & Emery, 1968; Böhlke & Chaplin, 1968; Mago, 1970; Gilbert, 1971; Nagelkerken, 1974). This constitutes the first record for Honduras.

Our material agrees well with the description of this species provided by Böhlke & Springer (1961). The following values for meristic characters are based on 10 specimens, all from Belize. Dorsal-fin elements: XVIII, 8 (1); XIX, 8 (7); XX, 7 (2). Anal-fin elements: II, 15 (3) or 16 (7). Pectoral-fin rays: 13 (1), 14 (7), 15 (2). Caudal-fin rays: 12 (1) or 13 (9).

The only consistent difference detected between our material from Belize and Honduras and the description of Bahaman specimens provided by Böhlke & Springer (1961) lies in the major pattern of pigmentation on the body. In the Bahaman specimens (according to Böhlke & Springer, 1961) the pattern typically consists of a more or less reticulate pattern of fine lightly pigmented lines that break up the darker background into blocks of irregular size and shape, usually arranged in about three horizontal tiers (illustrated in Böhlke & Chaplin, 1968, p. 526). In our material from the western Caribbean the pattern of body pigmentation in female specimens is usually much more regular (fig. 3A), consisting of 10 vertical bars of dark pigmentation separated by narrow lightly pigmented lines. Only the last two (posteriormost) bars are sufficiently irregular in outline as to correspond to the description of the Bahaman specimens. The first eight bars in virtually all female western Caribbean specimens are quite regular in outline and unbroken by horizontal white lines. All specimens, male and female, from the western Caribbean have a prominent dark spot enclosing the bases of the last dorsal-fin rays (fig. 3A, B). The presence of a dark spot enclosing the bases of the last several anal-fin rays is apparently a sexually dimorphic character, present in 25 of 28 female specimens examined for it, present in only one of 28 male specimens examined for it (chi-square = 41.35, $p < .001$). Sexual dimorphism in color pattern (in specimens in alcohol) is also evident in the lesser development of dark pigmentation on the body of males, the consequently lower contrast between the wide dark bars and the narrow light bars, and in the lesser vertical extent of the narrow light bars with a consequently incomplete definition of the barred color pattern ventrally (fig. 3B).

Color in life (male).—Taken from 35-mm Kodachrome. Head reddish brown with dark brown blotch on cheek posterioventrad to eye; upper and lower jaws, snout, interorbital, and ventral surface of head red; pupil black, surrounded by red iris with gold reflections. Body dark green, crossed by inconspicuous narrow

TABLE 15. Co-occurrence of species of *Starksia*. Values in upper half of matrix (whole numbers) are actual number of records (number of stations) of co-occurrence (based on all stations). Values in lower half of matrix are calculated GMI values (based on Class I stations only).

Species	N_T	N_I	Co-occurring species 22	23	24	25	26	27	28	29
22. *atlantica*	22	22	—	1	0	5	6	0	3	0
23. *elongata*	3	3	.02	—	0	1	2	2	0	1
24. *hassi*	2	2	0	0	—	1	1	0	0	0
25. *lepicoelia*	24	22	.12	.02	.04	—	9	1	0	1
26. *nanodes*	20	20	.18	.15	.05	.32	—	1	0	1
27. *occidentalis*	14	14	0	.18	0	0	0	—	1	1
28. *sluiteri*	4	4	.21	0	0	0	0	0	—	0
29. *starcki*	1	1	0	.29	0	0	.11	.13	0	—

Listing of species sharing highest GMI values with species of *Starksia* (five highest values only).

22. *atlantica*	39 (.55), 35 (.50), 4 (.38), 41 (.37), 55 (.34)
23. *elongata*	36 (.38), 29 (.29), 27 (.18), 38 (.16), 37 (.15)
24. *hassi*	50 (.19), 34 (.05), 26 (.05), 25 (.04), 33 (.04)
25. *lepicoelia*	34 (.43), 33 (.39), 26 (.32), 43 (.29), 50 (.29)
26. *nanodes*	50 (.49), 34 (.45), 33 (.37), 19 (.35), 25 (.32)
27. *occidentalis*	6 (.67), 15 (.49), 37 (.49), 38 (.46), 55 (.45)
28. *sluiteri*	3 (.47), 9 (.43), 7 (.42), 37 (.34), 35 (.28)
29. *starcki*	23 (.29), 48 (.25), 10 (.14), 27 (.13), 38 (.12)

N_T = total number of stations; N_I = number of Class I stations.

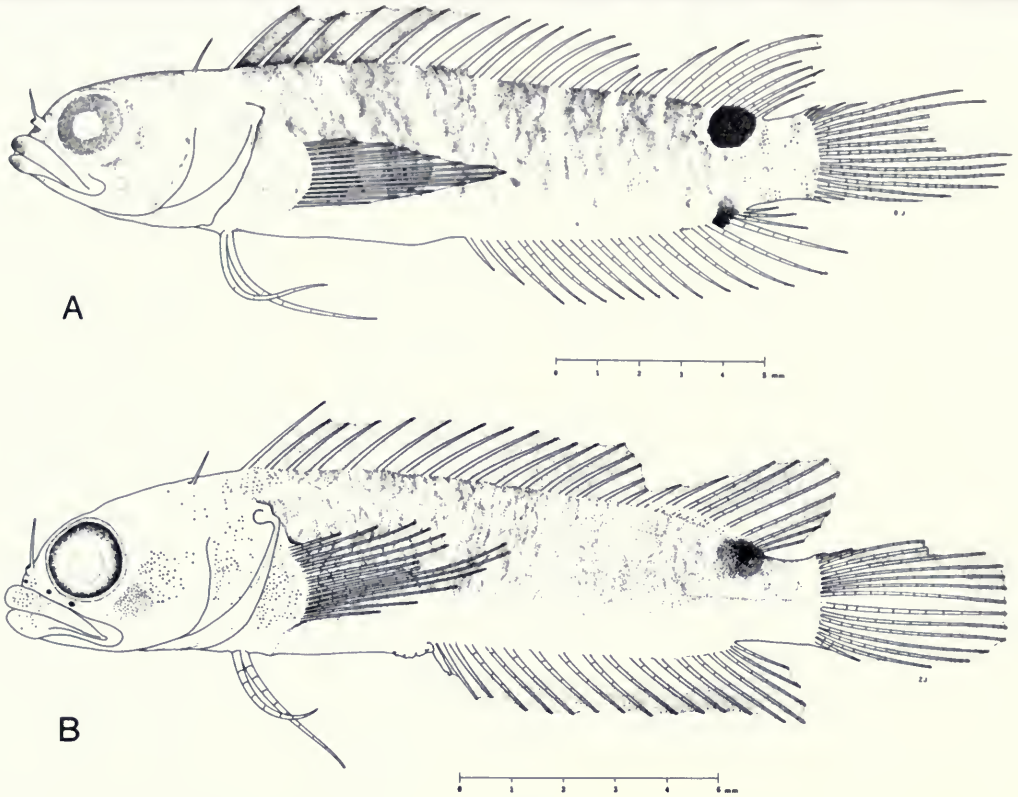

FIG. 3. **A,** *Starksia atlantica* Longley, 1934, female, FMNH 86012, 18.9 mm SL. **B,** *Starksia atlantica* Longley, 1934, male, FMNH 89346, 19.0 mm SL.

white bars. Spines and rays of dorsal fin dark green, membranes clear to dusky. Caudal, pelvic, and pectoral fins clear.

Color in life (female).—Taken from 35-mm Kodachrome. Head dark brown dorsally, light brown on sides; anterior portion of upper and lower jaws dark brown, remainder light brown; pupil black, surrounded by red iris with gold reflections. Body dark brown, crossed by conspicuous narrow white bars. Spines and rays of dorsal fin brown, membranes clear with small red spots along base of posterior portion of spinous dorsal fin and soft dorsal fin. Caudal fin dusky. Pectoral and pelvic fins clear.

Ecological data.—*Starksia atlantica* has been taken in collections where sampling extended to 80 ft, but most of our records (17 of 22) for this species are from stations in less than 15 ft, and a majority of both records (13 of 22) and specimens (39 of 70) are from stations in less than 6 ft. *Starksia atlantica* was taken only in areas of rich coral formations (table 13), and most specimens (96% of 70) were taken in outer reef and reef flat sites (H2) at Glovers Reef, Lighthouse Reef, or the Barrier Reef or from patch reefs (H3) in the lagoon at Glovers Reef. In Belize *S. atlantica* has been taken at Barrier Reef sites (BRG, CBC) and at the atolls (GR, LR, with additional records from TI). In Honduras *S. atlantica* was taken only in one deep (45 to 60 ft) station at Roatan. *Starksia atlantica* was taken with *S. elongata, S. lepicoelia, S. nanodes,* and *S. sluiteri* (table 15). *Starksia atlantica* shares highest affinity (GMI) values with *Acanthemblemaria greenfieldi* and *Enneanectes boehlkei.*

Material examined.—A total of 70 specimens from 22 collections. HONDURAS: IR, 84534 (1). BELIZE: BRG, 89405 (1); CBC, 89298 (2), 89305 (1), 89322 (8), 89334 (1), 89342 (1), 89346 (7), 89362 (6), 89370 (1), 89374 (3), 89387 (7), 89400 (1); GR, 71101 (1), 71130 (4), 77627 (14), 77628 (1); 77629 (1), 77631 (1), 86012 (6), 86013 (1); LR, 77630 (1). Additional Belize material examined: CBC, JWC-16 (2); LR, UMML 9497 (1); TI, UMML 9558 (7), UMML 9854 (6), UMML 10300 (1).

(23) **Starksia elongata** Gilbert, 1971

This species has previously been reported only from the southern Bahamas (Gilbert, 1971). This constitutes the first record for Belize and for Honduras and a significant range extension for the species.

Starksia elongata was described from eight specimens, five males, two females, and one unsexed individual, collected in the southern Bahamas on small- to medium-sized coral formations in 5 to 15 ft of water. We have collected *S. elongata* on three occasions, twice at the Hog Islands, once at Carrie Bow Cay. Two female specimens (FMNH 84575, 18.2, 19.1) were taken in 2 to 18 ft of water in surge channels in the windward edge of the reef-top in an area of good coral development on Little Hog Island (H2). One male specimen (FMNH 84576, 23.0) was taken in 50 ft of water on the leeward side of Northwest Cay (Hog Islands) in an area of good coral development (H1). One (female) specimen (FMNH 89368, 20.5) was taken in 0 to 4 ft of water in a patch reef formation near the south end of Carrie Bow Cay (H3). *Starksia elongata* was taken with five other species of *Starksia* (table 15).

All four specimens agree very well with Gilbert's (1971) description of *S. elongata.* We present only values for meristic characters here (based on all four

specimens in the order listed above). Dorsal fin: spines, 20, 21, 21, 20; segmented rays, 8 (all); total elements, 28, 29, 29, 28. Anal fin: spines, 2 (all); segmented rays, 17, 18, 17, 17. Pectoral-fin rays: 14 (all). Total elements, dorsal + anal + pectoral: 61, 63, 62, 61. Pelvic-fin segmented rays, 2 (all). Caudal-fin segmented rays, 13 (all). Arched lateral line scales, 18, ? 18, ? 18.

Material examined.—Four specimens from three collections. HONDURAS: CC, 84575 (2), 84576 (1). BELIZE: CBC, 89368 (1).

(24) **Starksia hassi** Klausewitz, 1958

This species has previously been reported from the Bahamas, Puerto Rico, Virgin Islands, Antigua, Guadeloupe, Bonaire, Venezuela, and Panama (Cervigon, 1968; Gilbert, 1971). This constitutes the first record for Belize.

Ecological data.—This species was taken only at two stations near the top of the dropoff zone at Glovers Reef, both at depths in excess of 60 ft, both in areas of rich coral development (H1). *Starksia hassi* was taken with *S. lepicoelia* and *S. nanodes* (table 15).

Material examined.—Two specimens from two collections. BELIZE: GR, 86014 (1), 86015 (1).

(25) **Starksia lepicoelia** Böhlke & Springer, 1961

This species has been reported from the Bahamas, Virgin Islands, Antigua, Old Providence Island, Grand Cayman Island, Turneffe Island and Lighthouse Reef (Belize), Honduras, Albuquerque Cays off Nicaragua, Alacran Reef, and Banco Chinchorro off Yucatan (Gilbert, 1971).

Ecological data.—*Starksia lepicoelia* was taken at more stations and is represented by more specimens than any other species of *Starksia* in our collections. This may well be an artifact of sampling effort, because the overwhelming majority of both records (17 of 24) and specimens (74 of 103) are from Glovers Reef (see table 3). *Starksia lepicoelia* was taken by us in less than 4 ft of water [IR, F75-14, large but isolated coral formation in Caribe Pt. Bite Bay (H3)], but the majority of both records (13 of 24) and specimens (66 of 103) are from depths in excess of 40 ft (table 6). All specimens of *S. lepicoelia* are from areas of rich coral development (table 13), and the clear majority of both records (15 of 24) and specimens (76% of 103) are from reef-front dropoff zones (H1 or, in the one case in which one specimen of *S. lepicoelia* was taken inquiline in a sponge, recorded as H9). *Starksia lepicoelia* was taken at a total of five sites, three in Belize (CBC, GR, LR) and two in Honduras (CC, IR). Additional records from Belize include Turneffe Island. *Starksia lepicoelia* was taken with all species of *Starksia* except *S. starcki*. *Starksia lepicoelia* shares highest affinity (GMI) values with *Enneanectes atrorus* and *E. altivelis*.

Material examined.—A total of 103 specimens from 24 collections. HONDURAS: CC, 84537 (2), 84538 (2); IR, 84535 (2), 84536 (8). BELIZE: CBC, 89296 (6), 89341 (4); GR, 70942 (1), 70970 (5), 70977 (1), 71080 (1), 71090 (1), 71106 (8), 71117 (10), 71134 (2), 71139 (1), 71143 (8), 71151 (1), 77632 (4), 77703 (5), 82589 (1), 84552 (1), 86019 (23), 86020 (1); LR, 77702 (5). Additional Belize material examined: LR, UMML 9411 (1), UMML 9474 (14); TI, UMML 9546 (4), UMML 9837 (4).

(26) **Starksia nanodes** Böhlke & Springer, 1961

This species has been reported from the Bahamas, Virgin Islands, Haiti, Old Providence Island, Grand Cayman Island, Colombia, Turneffe Island (Belize), and Albuquerque Cays off Nicaragua (Birdsong & Emery, 1968; Gilbert, 1971; Palacio, 1974). This constitutes the first record for Honduras.

Among the western Atlantic species of *Starksia*, only *S. elongata* and *S. nanodes* have a pair of hypural-shaped dark markings at the base of the caudal fin. These two species may be distinguished by characters provided in the key to *Starksia* by Gilbert (1971). They may also be distinguished, without overlap in character values, in the sum of total dorsal + anal + pectoral elements (table 16).

TABLE 16. Comparison of counts of total dorsal + anal + pectoral elements (spinous + soft) for *Starksia elongata* and *S. nanodes*.

Species	56	57	58	59	60	61	62	63	64	N
Starksia nanodes, Belize and Honduras	2	4	9	1	—	—	—	—	—	16
Starksia elongata, Belize and Honduras	—	—	—	—	—	2	1	1	—	4
Starksia elongata, Bahamas*	—	—	—	—	—	—	3	4	1	8

*Data from Gilbert 1971, p. 198.

Ecological data.—All but four records for this species are from depths in excess of 45 ft, and confirmed depth records extend to 90 to 100 ft (near the maximum depth of sampling in our data). All records are from areas of rich coral development (table 13), with the majority of both records (16 of 20) and specimens (79% of 57) from reef-front dropoff zones (H1). *Starksia nanodes* was taken at only four sites, two in Belize (CBC, GR), two in Honduras (CC, IR). The majority of records (12 of 20) are from Glovers Reef, but the majority of specimens (30 of 57) are from the Barrier Reef near Carrie Bow Cay. *Starksia nanodes* was taken with all species of *Starksia* except *S. sluiteri*. *Starksia nanodes* shares highest affinity (GMI) values with *Lucayablennius zingaro* and *Enneanectes atrorus* (table 15).

Material examined.—A total of 57 specimens from 20 collections. HONDURAS: CC, 84540 (4); IR, 84539 (2). BELIZE: CBC, 89304 (3), 89336 (5), 89347 (7), 89356 (6), 89361 (1), 89398 (8); GR, 77634 (1), 77635 (1), 77636 (1), 77637 (1), 77638 (3), 77639 (2), 77640 (2), 77808 + 86011 (2), 77809 (3), 86016 (1), 86017 (2), 86018 (2). Additional Belize material examined: TI, UMML 9576 (1).

(27) **Starksia occidentalis** Greenfield, 1978

This species ranges from the east side of the Yucatan Peninsula, Mexico, south along the coast of Central America to Panama (Greenfield, 1978). Records of *S. ocellata* from Old Providence Island (Fowler, 1950) and Panama (Gilbert, 1971) refer to this species.

Ecological data.—*Starksia occidentalis* has been taken in stations in which sampling extended to 50 ft, but most records (11 of 14) and specimens (40 of 53) are from less than 10 ft of water. *Starksia occidentalis* was taken in a variety of habitats (table 13), mainly coral and/or rock in Honduras (H2, H4, H9) and coral or coarse coral rubble (H2, H5) in Belize. In Belize *S. occidentalis* was taken at cays inside

the Barrier Reef (BC, FC, SC, TC) and at the Barrier Reef (BRG). Along with *Labrisomus kalisherae* and *Ophioblennius atlanticus macclurei*, *S. occidentalis* was the only species of blennioid represented in our collections to be taken at all four sites at cays behind the Barrier Reef (species taken at three of the four sites include: *Labrisomus nuchipinnis*, *Malacoctenus triangulatus*, *Paraclinus nigripinnis*). In Honduras *S. occidentalis* was taken at Roatan and the Hog Islands. *Starksia occidentalis* was taken with five of the other seven species of *Starksia* represented in our collections (table 15). It was taken with *S. elongata*, *S. lepicoelia*, *S. nanodes*, and *S. starcki* only at the Hog Islands (and in all but one case was taken with all at the same station, F75-48). *Starksia occidentalis* was taken with *S. sluiteri* only at the one Belize Barrier Reef collection (BRG) in which *S. occidentalis* was represented. *Starksia occidentalis* shares highest affinity (GMI) values with *Labrisomus kalisherae* and *Malacoctenus triangulatus*.

Material examined.—A total of 53 specimens from 14 collections. HONDURAS: CC, 84377 (5), 84378 (6), 84379 (2), 84380 (1), 84381 (6), 84383 (6), 84384 (9), 84581 (6); IR, 84382 (5). BELIZE: BC, 84386 (1); BRG, 84385 (1); FC, 84387 (1); SC, 84389 (1); TC, 84388 (3).

(28) **Starksia sluiteri** (Metzelaar, 1919)

This species has been recorded from Antigua, Dominica, Bonaire, Los Roques and Curacao (off Venezuela), Old Providence Island, Venezuela, Nicaragua, and Yucatan (Böhlke & Springer, 1961; Birdsong & Emery, 1968; Gilbert, 1971). This constitutes the first record for Belize.

Color in life.—Taken from 35-mm Kodachrome of specimens from Carrie Bow Cay. Head: yellowish brown dorsally; preopercle with large bluish black iridescent blotch bordered posteriorly with salmon-red; opercle brown with white line bordering preopercle on ventral half; anterior portion of upper lip with red bar, remainder of upper jaw and entire lower jaw and ventral surface of head yellow; white line running from ventral surface of eye along dorsal margin of upper jaw, under preopercular blotch and joining white line of opercle; eye with black pupil surrounded by narrow red ring on iris, remainder of iris black with five yellow lines radiating out from red ring in spokelike fashion to outer margin of eye; salmon-red line on circumorbital bones beginning under center of eye and extending dorsally along posterior margin of eye to line opposite top of orbit. Body with series of seven black blotches along side just above midline, smaller blotch above and below major row, lower row under and touching middle series, upper row set between middle series and touching dorsal fin, posteriormost blotches forming hypural blotch; edges of scales outlined with brownish red, centers tan above midline and bluish grey below midline; belly grey. Dorsal fin with pair of salmon-red dots above each black blotch of body that extends onto fin, fin spines dusky, membrane in anterior half of fin clear, posterior half of spinous dorsal fin and soft dorsal fin dusky, rays of soft dorsal fin black. Anal fin dusky with salmon-red margin. Caudal fin clear, crossed by numerous fine reddish brown lines, distal margin salmon-red. Pectoral fins clear with salmon-red ventral and posterior margins. Pelvic fins white.

Ecological data.—*Starksia sluiteri* is represented in our collections by six specimens taken at four stations, all in Belize, three at Barrier Reef sites (BRG, CBC), one at Glovers Reef. All stations positive for this species were in shallow water

(all less than 15 ft, all but one less than 5 ft). All stations were typified by richly developed coral formations in reef crest and fore-reef areas (H2). *Starksia sluiteri* was taken with three other species of *Starksia* (table 15) and shares highest affinity (GMI) values with *Labrisomus gobio* and *Malacoctenus aurolineatus.*

Material examined.—Six specimens from four collections. BELIZE: BRG, 86021 (1); CBC, 89294 (1), 89394 (3); GR, 86022 (1).

(29) **Starksia starcki** Gilbert, 1971

This species has previously been reported only from the type locality, Looe Key in the lower Florida Keys (Gilbert, 1971). This constitutes the first record for Honduras and a significant range extension for the species.

Gilbert's (1971) description of *S. starcki* was based on six (20.3 to 27.3) specimens from two collections. All specimens were taken in surge channels, less than 25 ft in depth. Our single specimen of *S. starcki* [FMNH 84574, 1 (16.3), original field number FMNH 75-48] was taken 20 May 1975 at Northwest Cay, Hog Islands, Honduras, in about 50 ft of water in an area of good coral development (H1). Three additional species of *Starksia* were represented in this collection (table 15).

Our identification of this specimen of *S. starcki* is based on comparison of the Honduras specimen with both Gilbert's (1971) description of *S. starcki* as well as with three paratypes of *S. starcki* examined by us.

An abbreviated description of the Honduras specimen follows. Meristic characters: dorsal-fin elements, XX, 9. Anal-fin elements, II, 18. Pectoral-fin rays, 13/13. Pelvic-fin elements, I, 2. Segmented caudal-fin rays, 13. Neither lateral line scale number or arrangement could be determined in the Honduras specimen, due to its small size. Morphometric characters: listed as thousandths of the SL, taken according to the methods of Gilbert (1971). Head length, 344. Snout length, 61. Upper jaw length, 135. Horizontal eye diameter, 92. Greatest body depth, 202. Length of first dorsal-fin spine, 86. Length of longest pectoral ray, 301. Length of longest pelvic-fin ray, 245. Belly fully scaled. Pores from infraorbital ossifications single. Nasal, supraorbital, and nuchal cirri simple, filamentous, and subequal in length. Neither vomerine or palatine teeth could be seen. Appressed pectoral-fin reaching a vertical through base of seventh segmented anal-fin ray. Appressed pelvic fin reaching past anal-fin origin. Major color pattern consisting of 10 irregular, broken, widely spaced chocolate bars on body which contrast strongly with a light background. Distribution of head and body pigmentation very similar to that described by Gilbert (1971) for the type series.

Gilbert (1971, p. 203) notes that soft dorsal- and anal-fin ray counts are higher in *S. starcki* than in *S. lepicoelia* (the only other western Atlantic species with a fully scaled belly), but that overlap occurs. We note that total dorsal- plus anal-fin ray counts will separate the two species without overlap (table 17).

Material examined.—One specimen from one collection. HONDURAS: CC, FMNH 84574 (1). We have also examined three paratypes of *S. starcki:* ANSP 109800, 1 (26.3); UF 16188, 1 (20.3); UF 17279, 1 (20.5).

Stathmonotus Bean, 1885

The genus *Stathmonotus* contains six described species, three in the western Atlantic and three in the eastern Pacific. The latest revision of *Stathmonotus* is

TABLE 17. Comparison of total dorsal-fin plus anal-fin counts (spinous + soft) for *Starksia lepicoelia* and *S. starcki*.

Species	43	44	45	46	47	48	49	50	51	N
Starksia lepicoelia, Belize and Honduras	1	2	19	6	6	—	—	—	—	34
Starksia starcki, Honduras	—	—	—	—	—	—	1	—	—	1
Starksia starcki, Florida*	—	—	—	—	—	—	2	3	1	6

*Data from Gilbert 1971, p. 202.

TABLE 18. Co-occurrence of species of *Stathmonotus*. Values in upper half of matrix (whole numbers) are actual number of records (number of stations) of co-occurrence (based on all stations). Values in lower half of matrix are calculated GMI values (based on Class I stations only).

Species	N_T	N_I	Co-occurring species 30	31	32
30. *gymnodermis*	1	1	—	0	0
31. *hemphilli*	1	1	0	—	1
32. *stahli tekla*	13	13	0	.14	—

Listing of species sharing highest GMI values with species of *Stathmonotus* (five highest values only).

30. *gymnodermis* 9 (.14), 7 (.14), 21 (.13), 2 (.12), 8 (.12)
31. *hemphilli* 17 (.50), 49 (.29), 47 (.25), 53 (.22), 57 (.19)
32. *stahli tekla* 35 (.37), 37 (.32), 51 (.32), 55 (.31), 27 (.31)

N_T = total number of stations; N_I = number of Class I stations.

that of Springer (1955b). All three western Atlantic species of *Stathmonotus* occur in our material from Belize and Honduras. Co-occurrence data for species of *Stathmonotus* is presented in Table 18.

(30) **Stathmonotus gymnodermis** Springer, 1955

This species has been reported from the Bahamas, Puerto Rico, Virgin Islands, and Venezuela (Springer, 1955b; Cervigon, 1966; Böhlke & Chaplin, 1968; Mago, 1970). This constitutes the first record for Belize and a significant range extension for the species.

Stathmonotus gymnodermis is represented in our material by one specimen (13.9 mm SL) taken at Glovers Reef in a reefcrest pool with a coral rubble and algae bottom in less than 2 ft of water (H6). Counts for this specimen follow: dorsal-fin elements, XLII, 0; anal-fin elements; II, 23; pectoral-fin rays, 8; segmented caudal-fin rays, 11. In both counts and other characters this specimen agrees well with Springer's (1955b) description of *S. gymnodermis*.

Material examined.—One specimen from one collection. BELIZE: GR, 86010 (1).

(31) **Stathmonotus hemphilli** Bean, 1885

This species has been reported from the Bahamas, Florida, St. Croix, Haiti, and Antigua (Springer, 1955b; Böhlke & Chaplin, 1968). This constitutes the first record for Honduras and a significant range extension for the species.

Stathmonotus hemphilli is represented in our material by one specimen (28.9 mm SL) taken at Big Hog Island from a massive living coral head in less than 6 ft

of water. Counts for this specimen are as follows: dorsal-fin elements, L, 0; anal-fin elements, II, 28; pectoral-fin rays, 4; segmented caudal-fin rays, 11. In both counts and other characters this specimen agrees well with the diagnosis of this species provided by Springer (1955b, p. 68).

Material examined.—One specimen from one collection. HONDURAS: CC, 84360 (1).

(32) **Stathmonotus stahli tekla** Nichols, 1910

Springer (1955b) recognized two subspecies of *S. stahli*, the nominate subspecies *S. s. stahli* (Evermann & Marsh, 1899), reported from Bonaire, Puerto Rico, Virgin Islands, Martinique, and Venezuela (Springer, 1955b; Cervigon, 1966; Mago, 1970), and *S. s. tekla* Nichols, reported from the Tortugas, Bahamas, Cuba, and Old Providence Island (Springer, 1955b; Böhlke & Chaplin, 1968). Birdsong & Emery (1968) reported *S. stahli* (without assignment of their material to subspecies) from Belize and Yucatan. We continue to follow Springer (1955b) and Böhlke & Chaplin (1968) in recording the form taken by us in Belize and Honduras as *S. s. tekla* (13 of 13 specimens counted had 11 segmented caudal-fin rays). This constitutes the first record for Honduras.

Ecological data.—*Stathmonotus stahli tekla* was taken in collections in which sampling extended to 30 ft, but the large majority of both records (11 of 13) and specimens (43 of 45) are from stations in less than 10 ft of water. Although *S. s. tekla* was taken in a variety of habitats (table 13), the clear majority of both records (9 of 13) and specimens (77% of 45) are from rich shallow-water coral formations (H2, H3), shallow areas typified by rocky ledges (H4), or both coral and rock reef formations (H9, in the case of F75-51, an exceptionally broad station). In Belize *S. s. tekla* was taken at cays inside of the Barrier Reef (BC, TC), Barrier Reef sites (CBC with an additional record from SWC), and the atolls (GR, LR with an additional record from TI). In Honduras *S. s. tekla* was taken at the Hog Islands and at Roatan. *Stathmonotus stahli tekla* was taken with *S. hemphilli* at the one station successful for the latter. *Stathmonotus stahli tekla* shares highest affinity (GMI) values with *Enneanectes boehlkei*, *E. pectoralis*, and *Entomacrodus nigricans* (table 18).

Material examined.—A total of 45 specimens from 13 collections. HONDURAS: CC, 84362 (1), 84363 (9), 84364 (5); IR, 84361 (2). BELIZE: BC, 86008 (1); CBC, 89291 (7), 89317 (2), 89341 (7), 89402 (1), 89415 (3); GR, 71125 (1), 86007 (1); FC, 86009 (5). Additional Belize material examined: CBC, JWC-19 (2); LR, UMML 9987; SWC, JWC-16 (1); TI, UMML 9856.

TRIPTERYGIIDAE

Enneanectes Jordan & Evermann, 1895

The family Tripterygiidae is represented in the western Atlantic by five species belonging to the New World genus *Enneanectes*. The western Atlantic species of *Enneanectes* were revised by Rosenblatt (1960). The status of eastern Pacific species remains unclear, pending publication of Rosenblatt's revision of the family (Rosenblatt, 1959), but none of the species of *Enneanectes* is amphi-American. All five western Atlantic species of *Enneanectes* are represented in our collections from Belize and Honduras. Co-occurrence data for species of *Enneanectes* is presented in Table 19.

TABLE 19. Co-occurrence of species of *Enneanectes*. Values in upper half of matrix (whole numbers) are actual number of records (number of stations) of co-occurrence (based on all stations). Values in lower half of matrix are calculated GMI values (based on Class I stations only).

Species	N_T	N_I	Co-occurring species 33	34	35	36	37
33. *altivelis*	28	28	—	8	10	0	5
34. *atrorus*	17	16	.28	—	0	0	0
35. *boehlkei*	29	29	.26	0	—	3	16
36. *jordani*	4	3	0	0	.23	—	3
37. *pectoralis*	20	20	.12	0	.57	.28	—

Listing of species sharing highest GMI values with species of *Enneanectes* (five highest values only).

33. *altivelis* 5 (.41), 25 (.39), 26 (.37), 22 (.31), 34 (.28)
34. *atrorus* 50 (.56), 26 (.45), 25 (.43), 43 (.34), 33 (.28)
35. *boehlkei* 4 (.70), 15 (.58), 37 (.57), 55 (.55), 22 (.50)
36. *jordani* 23 (.38), 37 (.28), 35 (.23), 55 (.22), 15 (.22)
37. *pectoralis* 55 (.64), 35 (.57), 4 (.57), 7 (.57), 15 (.51)

N_T = total number of stations; N_I = number of Class I stations.

(33) **Enneanectes altivelis** Rosenblatt, 1960

This species has been reported from the Bahamas and Central America, including Belize, Nicaragua, and Yucatan (Rosenblatt, 1960; Böhlke & Chaplin, 1968; Birdsong & Emery, 1968). This constitutes the first record for Honduras.

Ecological data.—*Enneanectes altivelis* has the broadest bathymetric distribution of any species of *Enneanectes* represented in our collections. It has been taken in less than 4 ft and as deep as 100 to 110 ft (the maximum depth of our sampling efforts). If capture records for *E. altivelis* are grouped into three depth categories (0-4, 5-59, ≧ 60 ft), the actual distribution of capture records (table 6) does not differ from what would be expected on the basis of distribution of sampling effort (table 2) ($\chi^2_2 = 2.70$, $p > .20$, Yates Correction applied). There is therefore in our data no evidence that *E. altivelis* exhibits a particular depth preference over the depth range covered by our samples. Virtually all records and specimens of *E. altivelis* came from areas typified by rich coral formations (table 20—the two records cited as H9 are from F75-47 and F75-51 in the Hog Islands, two exceptionally broad stations that included both rock and coral reef formations in the area sampled). The majority of both records (20 of 28) and specimens (81% of 113) came from reef-front dropoff zones (H1) or patch reefs (H3). In Belize *E. altivelis* was taken at Barrier Reef sites (BRG, CBC) and the atolls (GR, LR, with an additional record from Turneffe Island). In Honduras *E. altivelis* was taken at Roatan and the Hog Islands. *Enneanectes altivelis* was taken with three other species of *Enneanectes:* in deep water with *E. atrorus* and in shallow water with *E. boehlkei* and *E. pectoralis* (table 21). *Enneanectes altivelis* shares highest affinity (GMI) values with *Labrisomus haitiensis* and *Starksia lepicoelia* (table 19).

Material examined.—A total of 113 specimens from 28 collections. HONDURAS: CC, 84519 (3), 84520 (1), 84521 (6), 84522 + 84523 (7), 84524 (1); IR, 84518 (12). BELIZE: BRG, 89403 (1); CBC, 89349 (7), 89357 (4), 89399 (1); GR, 70966 (3), 86131 (1), 86132 (2), 86133 (8), 86134 + 86135 (3), 86136 + 86137 (3),

TABLE 20. Distribution of capture records of species of *Enneanectes* with respect to habitat categories. Data for each species given as number of records (whole numbers) and proportion of total individuals captured (decimal fractions).

Species	N	Habitat category H1	H2	H3	H4	H5	H6	H7	H8	H9
33. *altivelis*	28	12	5	8	1	—	—	—	—	2
	113	.46	.12	.35	.01	—	—	—	—	.07
34. *atrorus*	17	16	—	—	—	—	—	—	—	1
	39	.97	—	—	—	—	—	—	—	.03
35. *boehlkei*	29	—	14	9	3	—	—	—	—	3
	183	—	.44	.26	.18	—	—	—	—	.11
36. *jordani*	4	—	3	1	—	—	—	—	—	—
	9	—	.89	.11	—	—	—	—	—	—
37. *pectoralis*	20	—	11	3	3	2	—	—	—	1
	87	—	.72	.17	.05	.05	—	—	—	.01

TABLE 21. Number of stations at which *Enneanectes altivelis* was captured with other species of *Enneanectes* categorized by depth interval and habitat type.

Co-occurring species of *Enneanectes*	A. Depth interval (feet)*			
	0 to 4	5 to 39	≧ 40	N
34. *atrorus*	0	0	8	8
35. *boehlkei*	8	2	0	10
36. *pectoralis*	5	0	0	5

	B. Habitat type					
	H1	H2	H3	H4	H9	N
34. *atrorus*	8	0	0	0	0	8
35. *boehlkei*	0	4	3	1	2	10
36. *pectoralis*	0	3	0	1	1	5

* Stations assigned to depth interval on the basis of shallowest sampling depth.

86138 + 86139 (12), 86140 (2), 86141 (3), 86142 (5), 86143 (5), 86144 (3), 86145 (2), 86146 (1), 86147 (2), 86148 (8), 86149 (5), 86150 (2). Additional Belize material examined: LR, UMML 9490 (3), UMML 9566 (4); TI, UMML 10306 (2).

(34) **Enneanectes atrorus** Rosenblatt, 1960

This species has been reported from the Bahamas and from Turneffe Island (Belize) (Rosenblatt, 1960; Birdsong & Emery, 1968; Böhlke & Chaplin, 1968). This constitutes the first record for Honduras.

Ecological data.—*Enneanectes atrorus* has been taken only in relatively deep water, always at depths in excess of 30 ft, with most records (14 of 17) and specimens (31 of 39) from depths of 60 ft or more. We have taken this species in depths as great as 90 to 100 ft. All records are from reef-front dropoff zones (H1), including a record of one specimen (FMNH 82590) taken inquiline in a sponge (recorded as H9 in table 20). In Belize this species was taken only at the atolls (GR, LR, with an additional record at Turneffe Island). Whether it is truly absent from the Barrier Reef or not is unknown, but it was not taken in any of the six deep (> 40 ft) stations in the reef-front dropoff area at CBC. In Honduras we took this species only at the one deep (45 to 60 ft) station at Roatan in the dropoff zone outside the entrance to Dixon Cove. *Enneanectes atrorus* was taken only with *E. altivelis* among the species of *Enneanectes* and shares highest affinity (GMI) values with *Lucayablennius zingaro* and *Starksia nanodes* (table 19).

Material examined.—A total of 39 specimens from 17 collections. HONDURAS: IR, 84516 (4). BELIZE: GR, 70930 (1), 71078 (1), 71097 + 86116 (3), 82590 (1), 86115 (2), 86117 + 86118 (6), 86119 (5), 86120 (4), 86121 (1), 86123 (1), 86124 (1), 86125 (3), 86126 (2), 86128 (1), 89410 (1); LR, 86127 (2). Additional Belize material examined: TI, UMML 9852 (2).

(35) **Enneanectes boehlkei** Rosenblatt, 1960

This species has been reported from the Bahamas, Florida, Puerto Rico, Virgin Islands, Venezuela, and Central America, including Belize, Costa Rica, Nicaragua, and Yucatan (Rosenblatt, 1960; Caldwell, 1963; Cervigon, 1966; Birdsong & Emery, 1968; Böhlke & Chaplin, 1968; Mago, 1970). This constitutes the first record for Honduras.

Ecological data.—*Enneanectes boehlkei* has been taken in stations in which sampling extended to 30 ft, but most records (25 of 29) and specimens (166 of 183) are from stations in less than 15 ft. [Note that other than general locality (CC) we have no data for the series of seven specimens catalogued as FMNH 84515, and these specimens are excluded from all analyses.] The majority of records (23 of 29) and specimens (70% of 183) are from shallow richly developed coral formations (H2, H3; table 20). All but one of the remaining records and specimens are from areas of rocky ledges (H4) or two sites with both rock and coral represented in exceptionally broad Hog Island stations (F75-47, F75-51, H9 in table 20). In Belize *E. boehlkei* was taken at Barrier Reef sites (BRG, BRT, CBC, with an additional record from SWC) and at the atolls (GR, LR, with an additional record from TI). In Honduras *E. boehlkei* was taken at Roatan and the Hog Islands. *Enneanectes boehlkei* was taken with the three other species of *Enneanectes* occurring in shallow water but was not taken with the deep-water *E. atrorus*. *Enneanectes boehlkei* shares highest affinity (GMI) values with *Labrisomus guppyi* and *Malacoctenus triangulatus* (table 19).

Material examined.—A total of 190 specimens from 30 collections. HONDURAS: CC, 84506 (16), 84509 (7), 84510 (4), 84511 (5), 84512 (4), 84513 (15), 84514 (13), 84515 (7); IR, 84504 (1), 84505 (4). BELIZE: BRG, 86114 (2); BRT, 86105 (2); CBC, 89288 (1), 89290 (12), 89306 (2), 89321 (17), 89343 (8), 89348 (4), 89369 (4), 89371 (1), 89375 (4), 89382 (9); GR, 70931 (1), 86106 (2), 86109 (1), 86110 (2), 86111 (24), 86113 (1); LR, 86107 + 86108 (7), 86112 (10). Additional Belize material examined: LR, UMML 9480, UMML 9548; SWC, JWC-24 (3); TI, UMML 9826.

(36) **Enneanectes jordani** (Evermann & Marsh, 1900)

This species has been reported from the Bahamas, Puerto Rico, and Venezuela (Rosenblatt, 1960; Böhlke & Chaplin, 1968; Mago, 1970). This constitutes the first record for Belize and Honduras and a significant range extension for the species.

The rarity of *E. jordani* in our collections combined with the difficulty of determining key characters in several of the specimens (particularly lateral line scale counts, because several specimens were damaged in capture and/or preservation) aroused our suspicions as to the correctness of our identification. Reexamination of the material confirmed that the specimens listed below best agree with *E. jordani*. Böhlke & Chaplin (1968, p. 556) comment on the rarity of *E. jordani* in their Bahaman collections.

Ecological data.—We have taken *E. jordani* on only four occasions, once in Honduras (CC, 2 to 18 ft, H2), three times in Belize (BRB, 0 to 6 ft, H2; CBC, 0 to 4 ft, H3; GR, 3 to 15 ft, H2). *Enneanectes jordani* was taken with *E. boehlkei* and *E. pectoralis* (table 19).

Material examined.—A total of nine specimens from four collections. HONDURAS: CC, 84517 (2). BELIZE: BRB, 86130 (1); CBC, 89363 (1); GR, 86129 (5).

(37) **Enneanectes pectoralis** (Fowler, 1941)

This species has been reported from the Bahamas, Florida, Virgin Islands, Aruba, Martinique, Venezuela, and Central America, including Belize, Nicaragua, and Yucatan (Rosenblatt, 1960; Caldwell & Caldwell, 1964; Cervigon, 1966; Birdsong & Emery, 1968; Böhlke & Chaplin, 1968). This constitutes the first record for Honduras.

Ecological data.—*Enneanectes pectoralis* was taken in stations in which sampling extended to 18 ft, but a majority of records (14 of 20) and specimens (65 of 87) are from stations in less than 6 ft. *Enneanectes pectoralis* was taken in a number of shallow-water habitats (table 20), but most records (14 of 20) and specimens (89% of 87) are from richly developed shallow reef formations (H2, H3). In Belize *E. pectoralis* was the only species to be taken at cays inside the Barrier Reef (BC, TC). It was also taken at Barrier Reef sites (BRG, BRT, CBC) and at the atolls (GR, LR, with an additional record from TI). In Honduras *E. pectoralis* was taken at Roatan and the Hog Islands. *Enneanectes pectoralis* was taken with all three species of *Enneanectes* occurring in shallow water (table 19) but was not taken with the deep-water *E. atrorus*. *Enneanectes pectoralis* shares highest affinity (GMI) values with *Ophioblennius atlanticus macclurei* and *Enneanectes boehlkei*.

Material examined.—A total of 87 specimens from 20 collections. HONDURAS: CC, 84526 (1), 84527 (1), 84528 (7), 84529 (1), 84530 (1), 84531 (2); IR, 84525 (4). BELIZE: BC, 86155 (3); BRG, 86152 (8), 86158 (5); BRT, 86157 (3); CBC, 89289 (10), 89318 (8), 89364 (5), 89376 (11), 89381 (2); GR, 86151 (1), 86154 (10); LR, 86153 (3); TC, 86156 (1). Additional Belize material examined: TI, UMML 9571 (1).

CHAENOPSIDAE

The family Chaenopsidae is represented in the western Atlantic by 32 described species distributed among eight genera. In the following listing of western Atlantic chaenopsid genera, the numbers in parentheses indicate the following information: total number of western Atlantic species, number of species known from off the Central American coast, number of species represented in our material from Belize and Honduras. Western Atlantic chaenopsid genera include *Acanthemblemaria* (8, 6, 4), *Chaenopsis* (4, 1, 0), *Coralliozetus* (1, 1, 1), *Ekemblemaria* (1, 1, 0), *Emblemaria* (8, 3, 3), *Emblemariopsis* (8, 4, 3), *Hemiemblemaria* (1, 1, 1), and *Lucayablennius* (1, 1, 1). All western Atlantic chaenopsid genera and 18 of 32 described western Atlantic species are known from off the Central American coast. Of these, 13 species belonging to all genera but *Chaenopsis*[3] and *Ekemblemaria* are represented in our material. The names we employ for chaenopsid taxa treated in this paper are in accord with the recent literature: Stephens, 1963, 1970; Robins & Randall, 1965; Robins, 1971a; Smith-Vaniz & Palacio, 1974; Johnson & Greenfield, 1976. Co-occurrence data for chaenopsid species are presented in Table 22.

Acanthemblemaria Metzelaar, 1919

The genus *Acanthemblemaria* contains 14 species, eight in the western Atlantic and six in the eastern Pacific. The latest revision of western Atlantic species is that of Smith-Vaniz & Palacio (1974). The latest revision of eastern Pacific species is that of Stephens (1963). One additional eastern Pacific species has been described subsequently (Stephens et al., 1966).

Four of the eight recognized western Atlantic species occur in our collections from Belize and Honduras. The following species are not represented in our collections: *A. betinensis* Smith-Vaniz & Palacio, 1974 (Colombia, Panama, Costa Rica); *A. chaplini* Böhlke, 1957 (Florida, Bahamas); *A. medusa* Smith-Vaniz & Palacio, 1974 [Lesser Antilles, Tobago, Los Roques (Venezuela)]; *A. rivasi*

[3]See addendum.

TABLE 22. Co-occurrence of chaenopsid species. Values in upper half of matrix (whole numbers) are actual number of records (number of stations) of co-occurrence (based on all stations). Values in lower half of matrix are calculated GMI values (based on Class I stations only).

Species	N_T	N_I	Co-occurring species 38	39	40	41	42	43	44	45	46	47	48	49	50
38. *A. aspera*	25	17	—	7	2	5	0	2	0	1	2	3	2	2	1
39. *A. greenfieldi*	20	15	.13	—	2	10	0	0	0	1	2	2	1	1	0
40. *A. maria*	2	2	.22	.24	—	0	0	0	0	0	0	0	0	1	0
41. *A. spinosa*	17	10	.11	.36	0	—	0	1	0	1	2	1	1	0	0
42. *C. cardonae*	1	1	0	0	0	0	—	0	0	0	0	0	0	0	0
43. *E. caldwelli*	17	14	0	0	0	0	0	—	0	0	2	0	2	0	12
44. *E. hyltoni*	1	1	0	0	0	0	0	0	—	0	0	0	0	0	1
45. *E. pandionis*	3	0	—	—	—	—	—	—	—	—	0	0	0	0	0
46. *E. leptocirris*	6	4	0	.13	0	.16	0	0	0	—	—	2	1	0	1
47. *E. pricei*	7	4	.12	.13	0	0	0	0	0	—	.25	—	0	1	0
48. *E. signifera*	5	4	0	0	0	0	0	.13	0	—	0	0	—	0	4
49. *H. simulus*	3	3	.16	.02	.12	0	0	0	0	—	0	.04	0	—	0
50. *L. zingaro*	24	24	0	0	0	0	0	.55	.10	—	0	0	.31	0	—

Listing of species sharing highest GMI values with chaenopsid species (five highest values only).

38. *aspera*	27 (.46), 6 (.39), 35 (.36), 57 (.34), 8 (.30)
39. *greenfieldi*	22 (.55), 35 (.39), 41 (.36), 4 (.34), 55 (.24)
40. *maria*	39 (.24), 38 (.22), 49 (.12), 12 (.07), 9 (.06)
41. *spinosa*	4 (.38), 35 (.38), 22 (.37), 39 (.36), 53 (.27)
42. *cardonae*	28 (.25), 3 (.16), 9 (.14), 7 (.14), 2 (.12)
43. *caldwelli*	50 (.55), 19 (.41), 34 (.34), 26 (.31), 25 (.29)
44. *hyltoni*	34 (.12), 26 (.11), 22 (.11), 25 (.11), 50 (.10)
45. *pandionis*	Taken only at Class II stations
46. *leptocirris*	47 (.25), 35 (.19), 4 (.19), 15 (.18), 41 (.16)
47. *pricei*	35 (.28), 31 (.25), 17 (.25), 46 (.25), 22 (.21)
48. *signifera*	50 (.31), 28 (.25), 19 (.20), 10 (.14), 43 (.13)
49. *simulus*	12 (.41), 8 (.31), 53 (.29), 31 (.29), 17 (.29)
50. *zingaro*	34 (.56), 43 (.55), 26 (.49), 19 (.40), 48 (.31)

N_T = total number of stations; N_I = number of Class I stations.

Stephens, 1970 (Panama, Costa Rica) (distributional records from Smith-Vaniz & Palacio, 1974). Six of the eight known western Atlantic species of *Acanthemblemaria* occur off the Central American coast.

Of the four species of *Acanthemblemaria* collected, two (*A. maria* and *A. greenfieldi*) have been taken only in Belize, whereas *A. aspera* and *A. spinosa* are known from both Belize and Honduras. Specimens of *Acanthemblemaria* were obtained using both rotenone and quinaldine. In the case of *A. aspera*, *A. greenfieldi*, and *A. spinosa*, a substantial proportion (.27, .41, .60, respectively) of the total individuals were taken individually by squirting a mixture of quinaldine and isopropanol into the worm holes in which they live, thus providing detailed information on habitats.

(38) **Acanthemblemaria aspera** (Longley, 1927)

This species is known from the Bahamas, Florida, Greater Antilles, Dominica, St. Barthelemy, and Central America, including Belize, Costa Rica, Panama, Providencia (off Nicaragua), and Yucatan (Smith-Vaniz & Palacio, 1974). This constitutes the first record for Honduras.

Ecological data.—*Acanthemblemaria aspera* was taken in both shallow and relatively deep (60 to 80 ft) collections. A majority of records (16 of 25) are from stations in less than 20 ft. Smith-Vaniz & Palacio (1974, p. 215) state that records for this species extend to 18 m (we have one confirmed record from a station in which sampling was conducted between 60 and 80 ft), but that most specimens have been taken in less than 9 m. We have taken *A. aspera* in a wide variety of habitats (table 23), but coral was always present, varying from sparse, isolated heads (a number of collections at Hog Islands) to rich reef development (all Belize records except one station at Bugle Cay). *Acanthemblemaria aspera* occurs more frequently on the dead bases of *Montastrea* heads than on the bases of *Acropora palmata* or in pieces of coral rubble on the bottom (cf. *A. greenfieldi*, *A. spinosa*). Smith-Vaniz & Palacio (1974, p. 215) give the habitat of *A. aspera* as "Coral patch reefs, frequently on limestone substrates . . . ." *Acanthemblemaria aspera* was taken more frequently than any other chaenopsid species in Belize and Honduras. In Belize *A. aspera* was taken at cays inside the Barrier Reef (BC, SC), at Barrier Reef sites (AC, BRB, BRT, CBC), and at the atolls (GR with additional records from LR). In Honduras *A. aspera* was taken at Roatan and the Hog Islands. *Acanthemblemaria aspera* was taken with every other chaenopsid species represented in our collections (table 22) except *Coralliozetus cardonae* and *Emblemaria hyltoni* (each represented at only one station in our collections). This degree of co-occurrence is unique to *Acanthemblemaria aspera* among the chaenopsids and probably reflects (1) the abundance of this species and (2) the rather eurybathic distribution of this species (over the range of depths sampled by us). *Acanthemblemaria aspera* shares highest affinity (GMI) values with *Starksia occidentalis* and *Labrisomus kalisherae*.

Material examined.—A total of 140 specimens from 25 collections. HONDURAS: CC, 84341 (2), 84342 (1), 84343 + 84578 (10), 84344 (2), 84346 (1), 84470 (27), 84471 (1); IR, 84345 (20). BELIZE: AC, 82506 (2); BC, 86099 (1); BRB, 86101 (4); BRT, 86102 (1); CBC, 89350 (5), 89401 (16); GR, 77557 (1), 82515 (13), 82516 (1), 82517 (6), 82518 (3), 82520 (3), 82525 (5), 86100 (3), 86103 (1), 86104 (2); SC, 86098 (9). Additional Belize material examined: LR, UMML 9481 (1), UMML 9554 (1).

TABLE 23. Distribution of capture records of chaenopsid species with respect to habitat categories. Only those species represented in our collections by 10 or more individuals are included. Data for each species given as number of records (whole numbers) and proportion of total individuals captured (decimal fractions).

Species	N	Habitat category H1	H2	H3	H4	H5	H6	H7	H8	H9
38. *A. aspera*	25	7	7	4	3	2	—	—	—	2
	140	.13	.22	.15	.09	.07	—	—	—	.34
39. *A. greenfieldi*	20	—	5	14	—	—	—	—	—	1
	106	—	.48	.49	—	—	—	—	—	.03
41. *A. spinosa*	17	1	2	11	2	—	—	—	—	1
	50	.04	.10	.70	.14	—	—	—	—	.02
43. *E. caldwelli*	17	17	—	—	—	—	—	—	—	—
	71	1.00	—	—	—	—	—	—	—	—
45. *E. pandionis*	3	—	—	1	—	—	—	—	—	2
	24	—	—	.08	—	—	—	—	—	.92
47. *E. pricei*	7	2	1	3	—	—	—	—	—	1
	10	.30	.10	.50	—	—	—	—	—	.10
50. *L. zingaro*	24	24	—	—	—	—	—	—	—	—
	78	1.00	—	—	—	—	—	—	—	—

(39) **Acanthemblemaria greenfieldi** Smith-Vaniz & Palacio, 1974

This species has been reported from Providencia (off Nicaragua), Belize, Banco Chinchorro (off Yucatan), and Jamaica (Smith-Vaniz & Palacio, 1974).

Ecological data.—All of our records for *A. greenfieldi* are from depths less than 15 ft. All records from Glovers Reef (10 of 20 records, 43 of 106 specimens) are from patch reefs in the lagoon (H3). All other Belize records are from Barrier Reef sites (AC, BRB, BRT, CBC) and richly developed shallow reef formations (H2, H3). Smith-Vaniz & Palacio (1974, p. 211) describe the habitat of *A. greenfieldi* as "silt-free patch reefs in depths usually shallower than 10 m." *Acanthemblemaria greenfieldi* in Belize tends to occur in worm holes in pieces of coral rubble (mostly *Acropora*) on the bottom or in large dead pieces of *Montastrea* and usually is not found in holes in the dead basal portions of *Acropora palmata* (cf. *A. spinosa*). *Acanthemblemaria greenfieldi* has been taken with each of the three species of *Acanthemblemaria* represented in our collections. *Acanthemblemaria greenfieldi* shares highest affinity (GMI) values with *Starksia atlantica* and *Enneanectes boehlkei* (table 22). A detailed discussion of the ecology of *A. greenfieldi* is presented by Greenfield & Greenfield (in press).

Material examined.—A total of 106 specimens from 20 collections. BELIZE: AC, 82505 (6); BRB, 86092 (18); BRT, 86090 (3); CBC, 89284 (23), 89308 (1), 89315 (1), 89329 (6), 89340 (1), 89365 (1), 89373 (3); GR, 76348 (1), 76349 (2), 76350 (4), 77559 (4), 82514 (2), 82524 (5), 86091 (8), 86093 (10), 86094 (4), 86095 (3). Additional Belize material examined: CBC, JWC-23 (4).

(40) **Acanthemblemaria maria** Böhlke, 1961

This species has been reported from the Bahamas, Grand Cayman Island, Puerto Rico, St. Barthelemy, Dominica, St. Lucia, and Tobago (Smith-Vaniz & Palacio, 1974). This constitutes the first record for Belize and a significant range extension for the species. The two (22.8, 25.1) specimens from Belize agree well with the description of *A. maria* provided by Smith-Vaniz & Palacio (1974).

Ecological data.—*Acanthemblemaria maria* is apparently rare in Belize. We have collected only two specimens on two different occasions—both collections from the Barrier Reef (AC, 0 to 10 ft, H2; BRT, 0 to 3 ft, H2). Both specimens were taken from holes in pieces of coral rubble which had some algal cover. Smith-Vaniz & Palacio (1974, p. 206) describe the habitat of *A. maria* as follows: ". . . inhabits limestone slopes of rocky ledges in depths to 9 m, but usually shallower than 6 m." Both *A. aspera* and *A. greenfieldi* were taken at both stations.

Material examined.—Two specimens from two collections. BELIZE: AC, 86096 (1); BRT, 86097 (1).

(41) **Acanthemblemaria spinosa** Metzelaar, 1919

This species is known from the Bahamas, Florida, Greater and Lesser Antilles, Venezuela, Curacao, Albuquerque Cay, Isla San Andres, and Central America, including Belize and Nicaragua (Nagelkerken, 1974; Smith-Vaniz & Palacio, 1974). This constitutes the first record for Honduras.

Ecological data.—*Acanthemblemaria spinosa* was taken at only two stations in Honduras and at 15 stations in Belize. Only one of these 17 stations was in

relatively deep water (G74-10, GR, 60 to 80 ft, H1, two specimens), the remaining collections were from less than 15 ft. In Belize *A. spinosa* was taken only in areas of rich coral development (H2, H3), and 70% of the total individuals (N = 50) were from patch reefs at Glovers Reef or patch-reef-like formations behind the Barrier Reef and also just behind the reef crest at Carrie Bow Cay. The two Honduras collections were taken at the Hog Islands in areas of rock, rubble, sand, and isolated small coral heads (H4). Smith-Vaniz & Palacio (1974, p. 207) describe the habitat of *A. spinosa* as "coral patch reefs in depths ranging from 8 to 12 m." The ecology of *A. spinosa* is discussed by Greenfield & Greenfield (in press).

In Belize *A. spinosa* is normally not found in pieces of coral rubble but rather appears to occur most abundantly in worm holes in the dead basal portions of large trees of *Acropora palmata,* appearing to avoid holes in the living upper portions of the coral. Photographs have been taken of several individuals living in holes just below the lower margin of the living coral, demonstrating this restriction to basal dead coral. The coloration of the heads of various individuals match the background color of the algae around the worm hole, varying from red to yellow to green or brown. Large amounts of both epiphytic and epizooic growth in these dead areas not only render the fish more cryptic, but might also provide greater food resources. *Acanthemblemaria spinosa* is usually observed with just its head protruding from the worm hole in which it lives and is seldom seen to leave the hole. During several hours of observation, individuals of *A. spinosa* were seen to leave their holes only twice, each time darting out a distance of 3 to 6 cm and then returning to the hole. The movement was so rapid that if feeding occurred it was not observed. When approached (by a diver) while in its hole, an individual of *A. spinosa* performs an aggressive display consisting of opening the mouth widely and slowly swinging the head from side to side; this display continues until the intruder is within 6 to 10 cm of the fish, at which time it withdraws into its hole.

In Belize *A. spinosa* was taken only at Barrier Reef sites (BRB, CBC) and at Glovers Reef. *Acanthemblemaria spinosa* was taken with *A. aspera* and *A. greenfieldi* but not *A. maria. Acanthemblemaria spinosa* shares highest affinity (GMI) values with *Labrisomus guppyi* and *Enneanectes boehlkei* (table 22).

Material examined.—A total of 50 specimens from 17 collections. HONDURAS: CC, 84347 (5), 84348 (2). BELIZE: BRB, 86085 + 86088 (4); CBC, 89316 (2), 89328 (2), 89339 (3), 89372 (1), 89384 (1); GR, 77558 (1), 82523 (5), 86081 (1), 86082 (8), 86083 (1), 86084 (2), 86086 (4), 86087 (2), 86089 (6).

Coralliozetus Evermann & Marsh, 1899

The genus *Coralliozetus* contains six species, one in the western Atlantic and five in the eastern Pacific. The most recent revision of the genus (Stephens, 1963) was supplemented with the description of an additional species by Stephens et al. (1966). The sole western Atlantic representative of *Coralliozetus* is *C. cardonae.*

(42) **Coralliozetus cardonae** Evermann & Marsh, 1899

This species has been reported from the Bahamas, Puerto Rico, Virgin Islands, and Curacao (Stephens, 1963; Stephens et al., 1966; Böhlke & Chaplin, 1968; Nagelkerken, 1974). This constitutes the first record for Belize and a significant range extension for the species.

We have taken *C. cardonae* on only one occasion, a reef crest station in shallow water on the Barrier Reef (G78-7, CBC, 0 to 3 ft, H2). Our material of *C. cardonae* agrees well with descriptions of this species provided by Stephens (1963) and Stephens et al. (1966). Both specimens have two pairs of simple, short orbital cirri (unique to *C. cardonae* among western Atlantic chaenopsids), and both specimens exhibit a marked posteroventrally directed black-edged stripe extending from the posteroventral margin of the eye. Counts for the two specimens (15.5, 16.0, listed in that order) are as follows: spinous dorsal, 18, 18; soft dorsal, 10, 11; total dorsal-fin elements, 28, 29; anal fin, II+ 18, II+ 19; pectoral fin, 13, 13. Counts for both dorsal and anal fins differ from modal values listed for *C. cardonae* by Stephens et al. (1966, p. 436), and in the case of the 15.5-mm specimen the counts differ without overlap. With only two specimens of *C. cardonae* represented in our collections, we are not prepared at this time to comment on the significance, if any, of these differences.

Material examined.—Two specimens from one collection. BELIZE: CBC, 89395 (2).

Emblemaria Jordan & Gilbert, 1883

The genus *Emblemaria* contains 13 species, eight in the western Atlantic and five in the eastern Pacific. The most recent revision of the western Atlantic species is that of Stephens (1970); that of the eastern Pacific species is also by Stephens (1963). One additional western Atlantic species has been described subsequently (Johnson & Greenfield, 1976).

Only three of the eight described species of *Emblemaria* are known to occur off the Central American coast, and these three species occur in our collections from Belize and Honduras. The following species are not represented in our collections: *E. atlantica* Jordan & Evermann, 1898 (Bermuda, Georgia, western Florida); *E. biocellata* Stephens, 1970 (Venezuela, French Guiana, Colombia); *E. culmenis* Stephens, 1970 (Venezuela); *E. diphyodontis* Stephens & Cervigon, 1970 (Venezuela, Colombia); *E. piratula* Ginsburg & Reid, 1942 (west coast of Florida) (distributional records are from Stephens, 1970; Palacio, 1974; Shipp, 1975; Johnson & Greenfield, 1976).

(43) **Emblemaria caldwelli** Stephens, 1970

This species has been reported from the Bahamas, Jamaica, and Belize (Stephens, 1970; Johnson & Greenfield, 1976).

Color in life (male).—Taken from a 35-mm Kodachrome of FMNH 82519. Head rust, overlaid with heavy peppering of distinct black melanophores; jaws and interorbital darker rust than rest of head. Four yellow-gold spots along posterior edge of preopercle. Iris yellowish red. Body cream, overlaid by heavy peppering of distinct black melanophores, belly apparently paler due to larger and more widely spaced melanophores; a series of cream spots (areas lacking melanophores) along midline of body, most numerous on anterior three-fourths of body, numerous additional spots between midline and dorsal-fin base; reddish brown pigment visible internally along vertebral column, haemal and neural spines, and proximal radials of anal and dorsal fins. Caudal-fin base with reddish brown pigment on distal margin of hypural plate; caudal fin clear basally, distal halves of fin membranes black. Pelvic fins cream. Pectoral fins clear, three white spots on base. Anterior, elevated portion of dorsal fin black, first spine

with four evenly spaced white bands; posterior portion as well as entire anal fin cream with heavy peppering of melanophores, melanophores particularly concentrated on anterior portion.

Color in life (female).—Taken from a 35-mm Kodachrome of FMNH 86089. Head yellowish orange, overlaid with peppering of distinct, widely spaced black melanophores; jaws white, mottled with brown. Iris yellowish red. Belly reddish brown, remainder of body cream, overlaid with scattering of distinct melanophores and yellowish orange spots; posterior half of body translucent, reddish brown pigment clearly visible internally along vertebral column, haemal and neural spines, and proximal radials of anal and dorsal fins. Caudal-fin base with reddish brown pigment on distal margin of hypural plate, remainder of caudal fin clear. Pectoral and pelvic fins with slight pink tinge. Anal fin clear except for black pigment on elements and membranes of anterior portion. Spines and membranes of first five elements of dorsal fin black except for cream coloration on basal halves of membranes, remainder of fin clear with scattered pinkish bars on elements.

Ecological data.—*Emblemaria caldwelli* is a deep-water species. It has not been taken by us in less than 30 ft, and except for one specimen taken at 30 ft at Lighthouse Reef, all records and specimens are from depths exceeding 50 ft, with records extending to 80 to 90 ft. All records are from the reef-front dropoff zone (H1) at the Barrier Reef (CBC) or the atolls (GR, LR). *Emblemaria caldwelli* was not taken in Honduras. One specimen of *E. caldwelli* was collected with quinaldine from a worm hole in dead *Montastrea* that was adjacent to a similar hole inhabited by a specimen of *Acanthemblemaria aspera* (G76-28, GR, 50 ft). In addition to *A. aspera*, *E. caldwelli* was taken with four other chaenopsid species (table 22), but none of the species of *Emblemaria* were taken together. *Emblemaria caldwelli* shares highest affinity (GMI) values with *Lucayablennius zingaro* and *Paraclinus infrons*.

Material examined.—A total of 71 specimens from 17 collections. BELIZE: CBC, 89303 (4), 89313 (7), 89335 (7); GR, 71118 (3), 71135 (1), 71137 (3), 71140 (1), 71152 (2), 77560 (7), 77561 (4), 77563 (3), 77564 + 80414 (16), 82519 (1), 86069 (1), 86070 (2); LR, 77562 (1), 77589 (8).

(44) **Emblemaria hyltoni** Johnson & Greenfield, 1976 (fig. 4)

This species was described from five (20.4 to 22.9) male specimens taken off Dixon Cove, Isla Roatan, Honduras (Johnson & Greenfield, 1976). One additional specimen, a female (FMNH 84349, 23.1 mm SL), was taken with the type series but was not discovered until the entire collection was sorted (the males were preserved separately in the field) some months later, too late for inclusion in the original description. Because species of *Emblemaria* typically exhibit marked sexual dimorphism, we present an abbreviated description of the only known female specimen of *E. hyltoni*.

Meristic characters.—Total dorsal-fin elements 36 (XXI, 15); total anal-fin elements 24 (II, 22); pectoral-fin rays 14; pelvic-fin rays 2.

Morphometric characters.—Standard length 23.1 mm. Values expressed as thousandths of the SL. Head length 281. Head depth 160. Head width 139. Upper jaw length 109. Eye diameter (fleshy orbit) 70. Snout length 56. Interorbi-

tal width (bony) 20. Predorsal length 195. Preanal length 515. Caudal peduncle depth 75. Caudal peduncle length 78. Pectoral length 143. Pelvic length 294. Length of first dorsal-fin spine 745. Length of second dorsal-fin spine 299. Length of last dorsal-fin spine 70. Length of first soft-ray of dorsal fin 100. Length of orbital cirrus 58. Length of nasal cirrus 28.

Description.—First three dorsal-fin spines in female identical in configuration with that described for males (Johnson & Greenfield, 1976). Remainder of spinous and soft dorsal-fin elements somewhat shorter in female, e.g., length of last dorsal-fin spine 70 vs. 84 to 101 (all values for male specimens from Johnson & Greenfield, 1976), length of first soft ray of dorsal fin 100 vs. 100 to 114.

Pores.—Mandibular 4. Preopercular 5. Posttemporal 4. Supratemporal 3. Infraorbital 6. Supraorbital 2. Commissural 1. Anterofrontal 1. Nasal 1. All counts are for each side except for dorsomedial supratemporal and commissural series. Angle between supratemporal pores 89°.

Color in alcohol.—Body of female mostly lacking pigmentation (fig. 4), melanophores on body limited to the following areas: epaxial area of body just beneath anterior one-half of spinous dorsal-fin base, a few scattered melanophores on pectoral- and pelvic-fin bases, scattered melanophores at bases of some dorsal- and anal-fin elements, scattered melanophores on belly and adjacent to vent. First three dorsal-fin spines pigmented as in males, remaining rays and membranes of all fins unpigmented. Pigmentation best developed on snout and especially on lips, with scattered melanophores on occiput, cheeks, and gill covers. Isthmus and branchiostegal membranes unpigmented.

Sexual dimorphism.—Stephens (1963, p. 169) notes that the genus *Emblemaria* is characterized by a high degree of sexual dimorphism. This dimorphism is said to be most evident in the high sail-like dorsal fin of males vs. the typically low dorsal of females. Males also usually have longer jaws, longer pelvic fins, longer orbital cirri, and wider interorbitals than females. In *E. hyltoni* the most evident sexually dimorphic character is the relative lack of pigmentation in the female vs. the strong development of pigmentation in the males. It should be noted that the female specimen is the largest known individual of *E. hyltoni*. The configuration of the first three dorsal-fin spines is the same in both the female and male specimens, but the remainder of the hard and soft dorsal-fin elements are somewhat shorter in the female. There is some evidence for sexual dimorphism in the following morphometric characters [values for the female given first followed by the range of values for the five (20.4 to 22.9 mm) males]: upper jaw length, 109 vs. 127 to 135; orbital cirrus length, 58 vs. 77 to 115; interorbital width, 20 vs. 26 to 28; nasal cirrus length, 28 vs. 51 to 61; preanal distance, 515 vs. 462 to 483; length of last dorsal-fin spine, 70 vs. 84 to 101. No sexual dimorphism is evident in length of the first dorsal-fin spine, 745 vs. 676 to 751; length of the second dorsal-fin spine, 299 vs. 284 to 367; length of the longest pelvic-fin ray, 294 vs. 267 to 306; or in any of the other morphometric characters measured.

Material examined.—A total of six specimens from one collection. HONDURAS: IR, all specimens from FMNH 75-15 (45 to 60 ft; mistakenly reported as 30.5 m in Johnson & Greenfield, 1976) on the vertical coral face of the dropoff (H1) just outside the entrance to Dixon Cove, CAS 33511 (1), FMNH 80412 (1), FMNH 80413 (1), FMNH 84349 (1), UMMZ 200207 (1), USNM 214839 (1).

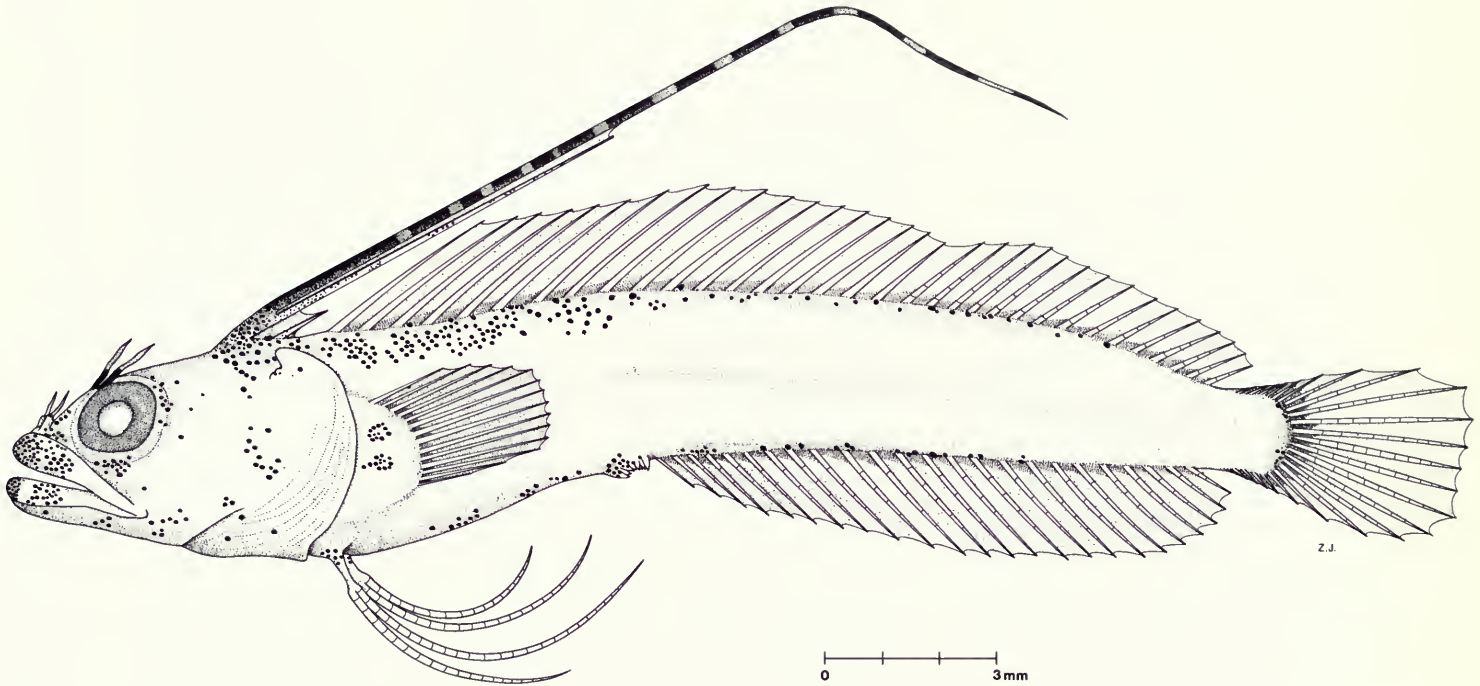

FIG. 4. *Emblemaria hyltoni* Johnson & Greenfield, 1976, female, FMNH 84349, 23.1 mm SL, from Isla Roatan, Honduras.

(45) **Emblemaria pandionis** Evermann & Marsh, 1900

This species is known from the Bahamas, Florida, Greater and Lesser Antilles, Venezuela, Colombia, Gulf of Mexico (Florida, Texas), and Central America, including Belize (Stephens, 1970; Palacio, 1974; Smith, 1976).

Color in life.—Taken from a 35-mm Kodachrome of a mature male, FMNH 86071. Head black, with iridescent blue spots on both jaws, ventral surface of head, and lower portions of gill membranes. Iris red. Body brownish, grading from dark brown anteriorly to tan centrally and then to a very light tan at caudal-fin base; scattered iridescent blue spots present along midline of body. Prepectoral-fin area brown; an iridescent blue line running along bases of fin rays, remainder of rays and membranes clear. Caudal-fin membranes and fin rays clear, fin rays crossed with five or six tan bars. Anterior half of anal fin black, posterior half clear, with slight dusky areas on distal half of fin rays and membranes. Anterior elevated portion of dorsal fin black; posterior portion mostly clear, tan along fin base and three or four light tan bars across each element. Pelvic fins black.

The color pattern of females in life is as given by Stephens (1963) for color in alcohol, with the body white and the markings brown.

Ecological data.—*Emblemaria pandionis* was taken only at Glovers Reef and only in three collections, in depths ranging from 6 to 15 ft. *Emblemaria pandionis* has been observed at Glovers Reef on numerous occasions. This species is found at Glovers Reef only in a very specific habitat, *viz.*, in empty worm or clam holes, in broken pieces of coral, in channel areas between patch reefs, in the lagoon, and often in channels in the reef where water enters the lagoon. Aggregations of *E. pandionis* are usually in areas of strong current. This species was taken only in Class II stations. The spectacular display of this species has been reported by Wickler (1967).

Material examined.—A total of 25 specimens from four collections. BELIZE: GR, 39827 (1), 71136 (16), 82527 (2), 86071 (6).

Emblemariopsis Longley, 1927

The genus *Emblemariopsis* contains eight species, all limited to the western Atlantic. The most recent revision of *Emblemariopsis* is that of Stephens, 1970. One additional western Atlantic species has been described subsequently (Greenfield, 1975).

Four of the eight described species of *Emblemariopsis* occur off the Central American coast, of which three are represented in our collections from Belize and Honduras. The following species are not represented in our collections: *E. bahamensis* Stephens, 1961 (Bahamas, Lesser Antilles, Grand Cayman Island, and Albuquerque Cays off Nicaragua); *E. bottomei* Stephens, 1961 (Venezuela); *E. diaphana* Longley, 1927 (Florida); *E. occidentalis* Stephens, 1970 (Bahamas, Lesser Antilles); *E. randalli* Cervigon, 1965 (Venezuela) (distributional records from Birdsong & Emery, 1968; Stephens, 1970).

(46) **Emblemariopsis leptocirris** Stephens, 1970

This species has been reported from the Bahamas, Puerto Rico, Virgin Islands, Antigua, and Grand Cayman Island (Stephens, 1970). This constitutes the first record for Belize and Honduras and a significant range extension for the species.

We assign the seven specimens reported here to *E. leptocirris* on the basis of the following characters: orbital cirrus present, none of the anteriormost dorsal-fin spines notably elongate, third dorsal-fin spine not notably shorter than the first two, dorsal fin not incised between second and fifth spines, anterior dorsal fin evenly covered with pigment to distal margin, vomerine teeth numbering about six, in one patch. Stephens' (1970) explanation of how he determined cephalic laterosensory pore counts is inadequate, and we have not attempted to duplicate his methods in making pore counts for the western Caribbean specimens. Values for meristic characters follow, based on five intact specimens (84577, 14.1; 86177, 19.0; 86179, 15.0; 89417, 16.9; 89418, 17.5) with values presented in that order. Dorsal fin: total elements, 31, 33, 32, 33, 32; spines, 20, 20, 21, 20, 19; segmented rays, 11, 13, 11, 13, 13. Anal fin: spines, 2 (all); segmented rays, 20, 22, 21, 22, 20. Pectoral-fin rays, 14, 13, 13, 13, 14.

Ecological data.—We have taken *E. leptocirris* on six occasions over a broad vertical range, from three stations in less than 5 ft to three stations at depths exceeding 40 ft (two of the three at depths exceeding 60 ft). Stephens (1970) does not give depth of capture information for the type series. In Belize *E. leptocirris* was taken only in reef-front dropoff zones (H1) or patch reefs (H3) at the Barrier Reef (CBC) and Glovers Reef. In Honduras *E. leptocirris* is known only from two specimens from one station at the Hog Islands (F75-41, 0 to 5 ft, H4). *Emblemariopsis leptocirris* was taken with *E. pricei* and *E. signifera* (table 22).

Material examined.—Seven specimens from six collections. HONDURAS: CC, 84577 (2). BELIZE: CBC, 89417 (1), 89418 (1); GR, 86177 (1), 86178 (1), 86179 (1).

(47) **Emblemariopsis pricei** Greenfield, 1975

This species was described from two (26.0 to 27.0) male specimens taken in about 4 ft of water on a patch reef at Glovers Reef near Long Cay (Greenfield, 1975). Subsequent to the description of *E. pricei,* we have taken eight additional specimens (17.0 to 26.1) in six collections. Five of these were collected at the type locality at Glovers Reef, Belize, two were taken at the Barrier Reef (CBC), and one specimen was collected at Big Hog Island, Honduras. Additional information on meristic and morphometric characters is presented in the form of ranges and means for measurements and frequencies for counts and includes values for the two type specimens. The discovery of two color morphs necessitates presentation of an expanded color description.

Description.—Total dorsal-fin elements: 33 (3), 34 (6), 35 (1), XX, 13 (1), XX, 14 (1), XXI, 12 (2), XXI, 13 (5), XXI, 14 (1); anal-fin elements, II, 22 (6), II, 23 (4); pectoral-fin rays, 14 (10); vertebrae, 39 (8); head length, 211-259 (236); head depth, 119-151 (123); head width, 115-135 (123); upper jaw length, 103-129 (115); orbital length, 42-66 (56); snout length, 27-44 (37); interorbital width, 23-28 (26); predorsal-fin length, 123-180 (155); preanal-fin length, 379-415 (400); caudal peduncle depth, 70-86 (77); caudal peduncle length, 78-89 (84); pectoral-fin length, 146-227 (188); pelvic-fin length, 88-173 (132); 1st dorsal-fin spine length, 54-85 (72); longest dorsal-fin spine, 80-118 (106); terminal dorsal-fin spine, 54-85 (65); 1st dorsal-fin soft ray, 78-105 (93).

Color in life (dark morph).—Taken from a 35-mm Kodachrome of FMNH 86181. Head black; dorsal surface of body along dorsal-fin base black from nape pos-

teriorly to sixth dorsal-fin spine; black gradually grades into grey from sixth dorsal-fin spine posteriorly to fifteenth dorsal-fin spine; pectoral fins black, distal portions of lower fin rays cream; pelvic fins black basally and cream distally; dorsal-fin spines and membranes black from first to eighth spine, posteriorly grading into grey to first soft ray; soft dorsal-fin membranes clear, fin rays clear with three or four regularly spaced reddish brown bands; anal-fin spines and connecting membranes black, membranes between first five soft anal-fin rays grey, remainder clear, fin rays clear with regularly spaced reddish brown bands; caudal fin clear; body translucent yellowish cream, nine or ten reddish brown pigment patches visible internally along vertebral column, interspaced with yellowish cream areas, reddish brown pigment also visible along neural and haemal spines in pigmented area of vertebral column and on alternating proximal radials of anal and dorsal fins.

Color in life (light morph).—Taken from a 35-mm Kodachrome of FMNH 86182. Head and body virtually transparent, internal structures clearly visible; head with reddish brown triangular-shaped bar extending from ventral portion of orbit posteriorly along upper margin of maxillary (also transparent); another reddish brown area under anteroventral portion of orbit extends ventrally across both lips; a series of very small bluish white iridescent spots on side of head, one spot between the two reddish brown areas and remainder posterior to orbit across preopercle and opercle; the small black spots on side of head as in color in alcohol; red gill membranes show through opercle; nine reddish brown pigment patches visible internally along vertebral column, interspaced with transparent areas; reddish brown pigment also present along every other neural and haemal spine in the pigmented areas of vertebral column radials of fins alternate with pigmented neural and haemal spines. Spines and soft rays of dorsal and anal fins clear with three or four regularly spaced reddish brown bands. Pectoral, pelvic, and caudal fins clear.

Color in alcohol.—FMNH 86182 (light morph), Figure 5. Head white with the following black markings: triangular-shaped bar extending from ventral portion of orbit posteriorly along upper margin of maxillary, widest under eye; interorbital, snout, anterior portions of lips and chin with a light peppering of melanophores; a single black spot slightly less than one-fourth pupil diameter posterior to orbit at level of dorsal margin of pupil, surrounded by a ring of smaller spots; scattered black spots on nape, preopercle, and opercle; a distinct black spot (about same size as postorbital spot) at junction of preopercle and opercle at the level of ventral margin of orbit. Body white, lacking pigmentation, except for one or two small black spots on pectoral-fin base. Pectoral, pelvic, and caudal fins clear. Anal fin clear except for a few faint brown areas on some fin rays. Dorsal fin clear except for a few faint brown areas on some fin rays and a few scattered small black spots on fin membranes between first five spines.

Color morphs.—*Emblemariopsis pricei* occurs in two color morphs (fig. 5), dark and light. Individuals collected from holes in living coral all have black heads and dark bodies, whereas those collected outside of holes, resting on or swimming over the coral, are all virtually transparent. The paler color morph was discovered, incidentally, while attempting to collect a dark morph from a hole in a large head of *Montastrea*, using quinaldine, at a depth of 100 ft at Glovers Reef. Two small, transparent fishes were observed actively swimming along the sur-

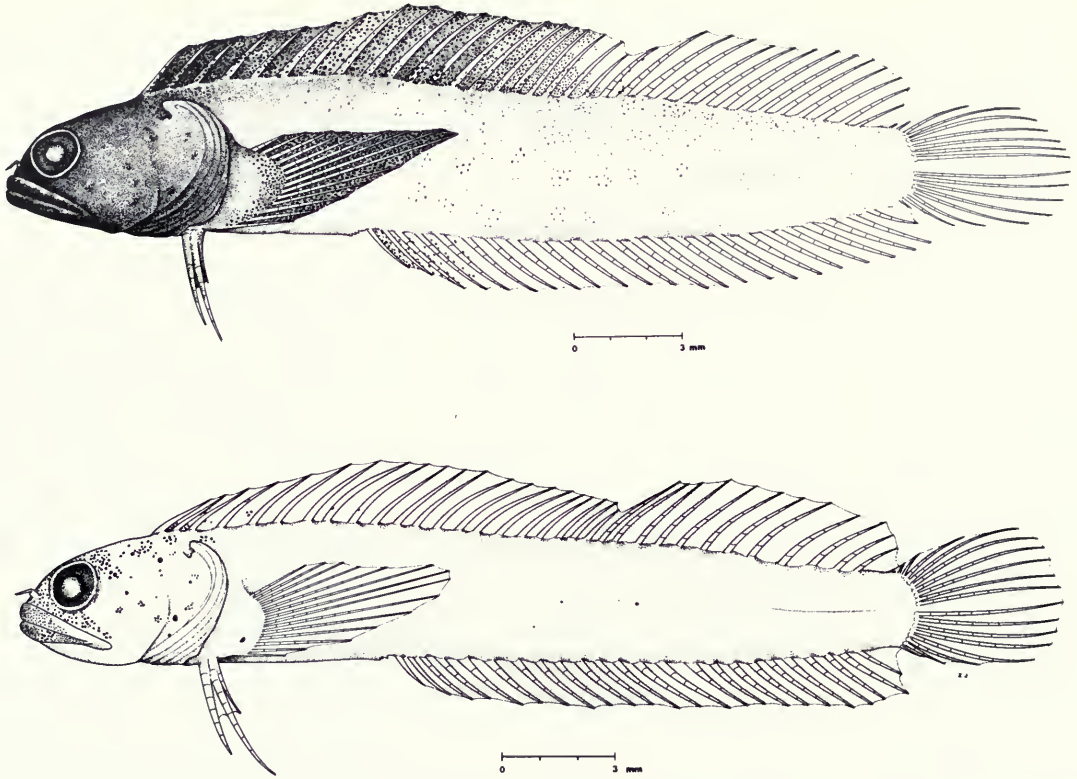

FIG. 5. *Emblemariopsis pricei* Greenfield, 1975, from Glovers Reef, Belize. **Above,** dark morph, FMNH 86181, 25.7 mm SL. **Below,** light morph, FMNH 86182, 23.6 mm SL. (See text for explanation.)

face of the coral head and darting around the entrance to the hole. One of the transparent fishes was collected with quinaldine and was later identified as *E. pricei*.

All of the known specimens of the dark morph are males. Examination of the two light morphs revealed that, in contrast to our expectations, these specimens were also males with well-developed genital papillae. This unusual situation may correlate with the acquisition of a hole by males. Individuals that inhabit holes have jet-black heads, in sharp contrast to the background of living coral in which they live. This distinctive coloration may be related to aggressive territorial display toward other males, attracting females to holes, or both. The nonterritorial males with their transparent bodies are very cryptic. Males with black heads would be conspicuous and thus vulnerable to predation if resting in the open on top of a coral head. It seems likely that the dark coloration is not attained until an individual is able to establish itself in a hole.

Ecological data.—*Emblemariopsis pricei* is apparently eurybathic over the depth range represented by our samples. This species has been taken in less than 4 ft and as deep as 100 ft. The common factor in all six stations is the presence of richly developed extensive coral formations (table 23; the one station labeled H9 is F75-51, a very broad station in the Hog Islands in which both rock and coral formations were sampled). At Glovers Reef *E. pricei* was taken twice in living *Acropora palmata* (in depths of 2 to 4 ft) and twice in living *Montastrea* (at depths of 50 to 100 ft). *Emblemariopsis pricei* was taken with *E. leptocirrus* (table 22).

Material examined.—A total of 10 specimens from seven collections. HONDURAS: CC, 84580 (1). BELIZE: CBC, 89419 (1), 89420 (1); GR, 77481 + 77482 (2) (holotype and paratype), 86180 (2), 86181 (2), 86182 (1).

(48) **Emblemariopsis signifera** (Ginsburg, 1942)

This species is known from the Bahamas, Lesser Antilles, near Rio de Janeiro (Brazil), Curacao, Colombia, and Grand Cayman Island (Stephens, 1970; Nagelkerken, 1974; Palacio, 1974). This constitutes the first record for Belize and Honduras and a significant range extension for the species.

Ecological data.—We have taken *E. signifera* on five occasions, and in each collection only one specimen was present. Three of the four records from Belize [those from CBC (2), GR (1)] are from 60 to 80 ft in the reef-front dropoff zone (H1). The fourth record from Belize (BRG) is from a station in less than 6 ft on the reef crest (H2). The one record from Honduras (CC, 50 ft, H1) is from a deep-water richly developed coral formation at Northwest Cay. *Emblemariopsis signifera* was taken with *E. leptocirris* and shares highest affinity (GMI) values with *Lucayablennius zingaro* (table 22).

Material examined.—A total of five specimens from five collections. HONDURAS: CC, 84579 (1). BELIZE: BRB, 86072 (1); CBC, 89421 (1), 89422 (1); GR, 86073 (1).

Hemiemblemaria Longley & Hildebrand, 1940

The genus *Hemiemblemaria* is monotypic.

(49) **Hemiemblemaria simulus** Longley & Hildebrand, 1940

This species has been reported from Florida and the Bahamas (Stephens, 1963; Böhlke & Chaplin, 1968). This constitutes the first record for Belize and Honduras and a significant range extension for the species.

Hemiemblemaria simulus has been taken twice in Honduras at the Hog Islands and once at Tom Owens Cay on the Barrier Reef in Belize. Uncatalogued collections at UMML were from two locations on the Barrier Reef in Belize. All collections are from depths of less than 10 ft and were from areas of coral rubble and scattered isolated heads of living coral.

Material examined.—A total of five specimens from three collections. HONDURAS: CC, 84359 (3), 84544 (1). BELIZE: BRT, 86171 (1). Additional Belize material examined: UMML, uncatalogued material collected by P. Colin: Queen's Cay, 26 Oct. 1972 (1); Tobacco Reef, 28 Oct. 1972 (2).

Lucayablennius Böhlke, 1957

The genus *Lucayablennius* is monotypic.

(50) **Lucayablennius zingaro** Böhlke, 1957

This species has been reported from the Bahamas, Jamaica, Colombia, and the western Caribbean, including Belize and Panama (Böhlke & Chaplin, 1968; Greenfield, 1972; Colin & Gomon, 1973; Palacio, 1974). This constitutes the first record for Honduras.

Ecological data.—*Lucayablennius zingaro* is a deep-water species. We have taken it only in distinct reef-front dropoff zones in areas of rich coral development (H1). All specimens were taken at depths exceeding 45 ft and at depths as great as 80 to 110 ft, the limit of our sampling efforts. *Lucayablennius zingaro* was observed at depths of 70 m off Belize and 106 m off Jamaica by Colin (1974). A majority of records (14 of 24 records) and specimens (49 of 78) are from Glovers Reef. Other Belize specimens are from the Barrier Reef (CBC) and Lighthouse Reef (LR). In Honduras *L. zingaro* was taken only at the two deepest stations, FMNH 75-15 (IR, 45 to 60 ft) and FMNH 75-48 (CC, 50 ft). *Lucayablennius zingaro* was taken only with chaenopsid species that occur in deep water, *viz.*, *Acanthemblemaria aspera* (1 station), *Emblemaria caldwelli* (12 stations), *E. hyltoni* (1 station), *Emblemariopsis leptocirris* (1 station), and *E. signifera* (4 stations) (table 22). *Lucayablennius zingaro* shares highest affinity (GMI) values with *Enneanectes atrorus* and *Emblemaria caldwelli*.

Material examined.—A total of 78 specimens from 24 collections. HONDURAS: CC, 84542 (2); IR, 84541 (5). BELIZE: CBC, 89302 (3), 89312 (4), 89326 (1), 89333 (2), 89358 (3), 89360 (2); GR, 70823 (3), 70824 (4), 70825 (3), 70826 (11), 70827 (6), 70828 (1), 71008 (2), 71119 (1), 71141 (2), 71153 (3), 77567 (2), 86076 (4), 86077 (2), 86176 (5); LR, 77565 (2), 77566 (5).

BLENNIIDAE

Of the four families of tropical western Atlantic blennioid fishes treated in this paper, the Blenniidae is unquestionably in greatest need of thorough review and revision. We have not attempted to compile figures on the total number of

TABLE 24. Co-occurrence of blenniid species. Values in upper half of matrix (whole numbers) are actual number of records (number of stations) of co-occurrence (based on all stations). Values in lower half of matrix are calculated GMI values (based on Class I stations only).

Species	N_T	N_I	Co-occurring species 51	52	53	54	55	56	57
51. *E. nigricans*	21	20	—	0	4	0	14	0	5
52. *H. aequipinnis*	3	3	0	—	0	0	1	1	1
53. *H. springeri*	7	5	.29	0	—	0	5	0	3
54. *L. dispar*	4	4	0	0	0	—	0	0	0
55. *O. atlanticus macclurei*	30	30	.48	.01	.32	0	—	0	6
56. *P. marmoreus*	1	1	0	.29	0	0	0	—	0
57. *S. cristata*	7	7	.31	.03	.32	0	.32	0	—

Listing of species sharing highest GMI values with blenniid species (five highest values only).

51. *E. nigricans*	9 (.53), 7 (.51), 4 (.49), 35 (.49), 37 (.49)
52. *H. aequipinnis*	56 (.29), 11 (.04), 57 (.03), 8 (.02), 14 (.02)
53. *H. springeri*	57 (.32), 55 (.32), 49 (.29), 51 (.29), 37 (.29)
54. *L. dispar*	Not taken with any other blennioid species.
55. *O. atlanticus macclurei*	37 (.64), 4 (.62), 15 (.57), 35 (.55), 51 (.48)
56. *P. marmoreus*	52 (.29), — (—), — (—), — (—), — (—)
57. *S. cristata*	8 (.54), 6 (.53), 12 (.46), 21 (.37), 27 (.37)

N_T = total number of stations; N_I = number of Class I stations.

either species or genera in the tropical western Atlantic for this family. Names used in this paper are in accord with the available literature (Jordan & Evermann, 1898; Meek & Hildebrand, 1928; Norman, 1943; Tavolga, 1954; Springer, 1967, 1968; Springer & Smith-Vaniz, 1970; Böhlke & Chaplin, 1968; Randall, 1968; Dawson, 1970; Bath, 1977). Co-occurrence data for blenniid species is presented in Table 24.

Entomacrodus Gill, 1859

There are four species of *Entomacrodus* in the Atlantic Ocean, but only *E. nigricans* is known to occur in the Caribbean Atlantic area (Springer, 1967, 1972).

(51) **Entomacrodus nigricans** Gill, 1859

This species is known from Bermuda, the Bahamas, Florida, Greater and Lesser Antilles, Venezuela, Curacao, Colombia, and Central America, including Belize, Costa Rica, Nicaragua, Panama, and Yucatan (Rubinoff & Rubinoff, 1962; Caldwell, 1963; Caldwell & Caldwell, 1964; Cervigon, 1966; Springer, 1967; Birdsong & Emery, 1968; Böhlke & Chaplin, 1968; Mago, 1970; Nagelkerken, 1974). This constitutes the first record for Honduras.

Ecological data.—Entomacrodus nigricans was taken in only one station in which sampling extended deeper than 10 ft (F75-45, 2 to 18 ft, H2), and the vast majority of records (16 of 21) and specimens (308 of 367) are from less than 5 ft. *Entomacrodus nigricans* was taken in a variety of shallow-water habitats (table 25). Nearly half of the records (10 of 21) were in shallow fringing reefs or reef crest (H2) areas (including stations at CC, IR, BRT, CBC, GR, LR). A large majority of

TABLE 25. Distribution of capture records of blenniid species with respect to habitat categories. Only those species represented in our collections by nine or more individuals are included. Data for each species given as number of records (whole numbers) and proportions of total individuals captured (decimal fractions).

Species	N	Habitat category H1	H2	H3	H4	H5	H6	H7	H8	H9
51. *E. nigricans*	21	—	10	1	4	—	5	—	—	1
	367	—	.11	.01	.45	—	.33	—	—	.10
52. *H. aequipinnis*	3	—	—	—	—	—	—	—	1	2
	18	—	—	—	—	—	—	—	.72	.28
53. *H. springeri*	7	—	1	3	2	—	—	—	—	1
	9	—	.22	.33	.33	—	—	—	—	.11
54. *L. dispar*	4	—	—	—	—	—	—	—	4	—
	19	—	—	—	—	—	—	—	1.00	—
55. *O. atlanticus macclurei*	30	—	15	5	3	4	—	—	1	2
	377	—	.67	.03	.23	.02	—	—	.03	.04
57. *S. cristata*	7	—	—	—	4	1	—	—	1	1
	33	—	—	—	.85	.03	—	—	.09	.03

the total specimens (88% of 367) came from reef crest pools (H6) at Glovers Reef or from shallow, rocky areas (H4) at the Hog Islands (including one exceptionally broad station, F75-51, in which both rock and coral reefs were sampled). In the Bahamas, according to Böhlke & Chaplin (1968, p. 563), *E. nigricans* ". . . lives in tide pools, on rocky slopes, and in locations where there are boulders on the bottom." All but one of the records for this species from Glovers Reef are from tide pool areas.

At Long Cay, Glovers Reef, we have observed *E. nigricans* at night (9:30 PM) resting in small depressions in pieces of coral rubble along the shore, which were completely out of the water. Their bodies were only partly covered with water, and respiratory movements were very rapid. Stomach analyses of these individuals showed that they were not feeding.

Entomacrodus nigricans has been taken with three other blenniid species (table 24), but a number of these records of co-occurrence may reflect a basic artifact of our sampling method (it is still the only practical method), *viz.*, the inclusion of many species in one sample which may differ greatly in microhabitats. For example, *E. nigricans* has been taken seven times in Belize at H2 stations at which *Ophioblennius atlanticus macclurei* was also taken. All of these stations were relatively broad, ranging from close to the shoreline out into slightly deeper water (less than 5 ft maximum depth, except for one station extending to 15 ft maximum depth). At Glovers Reef, *O. a. macclurei* appears to replace *E. nigricans* in the deeper water areas of the wave-swept shore, away from the intertidal area. Thus the relatively high calculated affinity value (GMI = 0.480) shared by these two species may in part reflect the scale over which our samples were taken. *Entomacrodus nigricans* shares highest affinity (GMI) values with *Malacoctenus aurolineatus* and *Labrisomus nigricinctus* (table 24).

Material examined.—A total of 367 specimens from 21 collections. HONDURAS: CC, 84556 (82), 84557 (44), 84558 (1), 84559 (5), 84560 (22), 84561 (38), 84562 (16); IR, 84555 (12). BELIZE: BRT, 86172 (5); CBC, 89282 (7), 89323 (3), 89344 (5), 89377 (35); GR, 77529 (14), 77574 (1), 77576 (9), 77801 + 89423 (14), 86074 (1), 86075 (83); LR, 77573 (1), 77575 (1). Additional Belize material: CBC, JWC-18 (1); LR, UMML 9981.

Hypleurochilus Gill 1861

The most recent partial revisions of *Hypleurochilus* are those of Randall (1966) and Bath (1977). According to Bath there are seven species of *Hypleurochilus*, four of which occur in the Caribbean Atlantic area. Two of these four species are unknown from the western Caribbean: *H. geminatus* Wood (South Atlantic and Gulf coasts of the United States, a complex consisting of more than one species according to Randall) and *H. bermudensis* Beebe & TeeVan (Bermuda, the Bahamas, Florida; records from Jordan & Evermann, 1898; Randall, 1966; Böhlke & Chaplin, 1968). The two species remaining, *H. aequipinnis* (Günther) and *H. springeri* Randall, are represented in our collections from Belize and Honduras.

(52) **Hypleurochilus aequipinnis** (Günther, 1861)

This species was described from one specimen taken in west Africa. In the western Atlantic *H. aequipinnis* is known from the Bahamas, Florida, Greater and Lesser Antilles, Venezuela, and Central America, including Guatemala and

Yucatan (Cervigon, 1966; Randall, 1966; Böhlke & Chaplin, 1968; Mago, 1970; Bath, 1977). This constitutes the first record for Belize and Honduras.

Ecological data.—*Hypleurochilus aequipinnis* has been collected by us once in Belize (G74-14, FC) in mangrove roots (H9) at a cay inside of the Barrier Reef, once in a mangrove channel (H9) at Roatan, and once on a pier piling (H8) at Trujillo, Honduras. All three stations were at depths of 3 to 10 ft. In Belize *H. aequipinnis* was taken with *Parablennius marmoreus* (at FC) and in Honduras was taken with *Scartella cristata* and *Ophioblennius atlanticus macclurei* at Trujillo.

Material examined.—A total of 18 specimens from three collections. HONDURAS: IR, 84569 (2); mainland: main pier at Trujillo, 84570 (13). BELIZE: FC, 86170 (3).

(53) **Hypleurochilus springeri** Randall, 1966

This species is known from the Bahamas, Florida, Greater and Lesser Antilles, Venezuela, Curacao, Grand Cayman Island, and Central America, including Albuquerque Cay off Nicaragua (Randall, 1966; Birdsong & Emery, 1968; Böhlke & Chaplin, 1968; Mago, 1970; Nagelkerken, 1974). This constitutes the first record for Belize and Honduras.

Ecological data.—We have taken *H. springeri* on seven occasions at stations in which sampling extended (maximally) to 15 ft. Although the Honduras collections, all rotenone stations, suggest co-occurrence with three other blenniid species (table 24), this may in part reflect the scale of sampling (see discussion under *Entomacrodus nigricans*). In two of the four Belize records, stations in which sampling was done using quinaldine, specimens of *H. springeri* were found only on the upper portions of living trees of *Acropora palmata*. Only in the Belize collections in which rotenone was used (CBC, G 78-13; GR, G 73-50) were two additional blenniid species taken—*Entomacrodus nigricans* and *Ophioblennius atlanticus macclurei*. Böhlke & Chaplin (1968, p. 568) describe the habitat of *H. springeri* as follows: "All known specimens are from water less than 10 ft deep, most from rocky bottom along a sandy shoreline, in clear water that is relatively calm." Except for the sandy shoreline, this sentence, as far as it goes, could describe the H4 stations in Honduras at which *H. springeri* was taken. In Belize *H. springeri* was taken at the Barrier Reef (CBC) and Glovers Reef. In Honduras *H. springeri* was taken at the Hog Islands. *Hypleurochilus springeri* shares highest affinity (GMI) values with *Scartella cristata* and *Ophioblennius atlanticus macclurei*.

Material examined.—A total of nine specimens from seven collections. HONDURAS: CC, 84571 (2), 84572 (1), 84573 (1). BELIZE: CBC, 89386 (1); GR, 86167 (1), 86168 (2), 86169 (1).

Lupinoblennius Herre, 1942

According to Bath (1977) the genus *Lupinoblennius* contains two species: *L. nicholsi* (Tavolga, 1954) (known from Florida and the Gulf of Mexico at Tamaulipas, Mexico) and *L. dispar*.

(54) **Lupinoblennius dispar** Herre, 1942

This species is known from Jamaica, Antigua, Trinidad, and Central America, including Guatemala, Nicaragua, Panama, and Yucatan. In Panama *L. dispar* has

also been taken in the Miraflores Third Lock, Panama Canal, Pacific side (records from Dawson, 1970). This constitutes the first record for Belize and Honduras and is an addition to Miller's (1966, 1976) lists of the freshwater fishes of Central America.

Ecological data.—*Lupinoblennius dispar* is the only species of blennioid fish taken by us that was not taken with any other blennioid species. All collections of *L. dispar* are from the mainland (H8), from shallow water (less than 4 ft), and from low salinity areas. The specimen taken at Gales Point (86080) was taken in freshwater.

Material examined.—A total of 19 specimens from four collections. HONDURAS: mainland: Brus Lagoon, Cannon Island, 84550 (7). BELIZE: mainland: beach at St. John's College, Belize City, 86079 (5); mangrove shore just outside entrance to boat canal at St. John's College, Belize City, 89412 (6); southern lagoon at Gales Point, 86080 (1).

Ophioblennius Gill, 1860

The genus *Ophioblennius* contains two species, each represented by two subspecies (Springer, 1962). In the eastern Pacific are *O. steindachneri steindachneri* Jordan & Evermann, 1896 (widespread in eastern Pacific, California to Peru) and *O. s. clippertonensis* Springer, 1962 (Clipperton Island). In the Atlantic are *O. atlanticus atlanticus* (Valenciennes, 1836) (eastern Atlantic and Brazil) and *O. a. macclurei* (Silvester, 1915) (widespread in Caribbean Atlantic area).

(55) **Ophioblennius atlanticus macclurei** (Silvester, 1915)

This subspecies is known from Bermuda, the Bahamas, North Carolina, Georgia, Florida, Greater and Lesser Antilles, Venezuela, Curacao, and Central America, including Belize, Costa Rica, Nicaragua, Panama, and off Yucatan (Rubinoff & Rubinoff, 1962; Springer, 1962; Caldwell, 1963; Cervigon, 1966; Birdsong & Emery, 1968; Böhlke & Chaplin, 1968; Mago, 1970; Nagelkerken, 1974). This constitutes the first record for Honduras. All specimens counted (N = 15) in our western Caribbean material agree with Springer's (1962) values for *O. a. macclurei* in having 31 or 32 total dorsal-fin elements and 22 or 23 total anal-fin elements.

Ecological data.—We have taken *Ophioblennius atlanticus macclurei* in stations in which sampling extended to 20 ft, but the great majority of records (28 of 30) and specimens (338 of 377) are from stations in less than 15 ft, and 21 of 30 records are from stations in less than 6 ft. *Ophioblennius atlanticus macclurei* was taken in a variety of shallow-water habitats (table 25). In Belize a majority of records (12 of 21) are from rich shallow wave-swept coral reef sites (H2). Two habitats, H2 and H4, accounted for 94% of the 377 specimens taken (includes the two exceptionally broad stations at the Hog Islands, F 75-47 and F 75-51). Although represented by more specimens in our collections than any other blennioid species (table 1), abundance figures for *O. a. macclurei* are underestimates in that in a number of cases not all of the individuals killed at a particular rotenone station were collected (the collectors were greatly limited by time and manpower, and thus "rare" species may well be overrepresented in terms of abundance figures). A detailed description of the habitat preferences and territorial behavior of *O. a.*

macclurei is provided by Nursall (1977). We have taken *O. a. macclurei* in Belize at cays inside the Barrier Reef (BC, FC, SC, TC), at Barrier Reef sites (BRG, BRT, CBC), and at the atolls (GR, LR). In Honduras we have taken this species at the Hog Islands and on the mainland (pier at Trujillo). *Ophioblennius atlanticus macclurei* was taken with four other blenniid species (table 24) and shares highest affinity (GMI) values with *Enneanectes pectoralis* and *Labrisomus guppyi*.

Material examined.—A total of 377 specimens from 30 collections. HONDURAS: CC, 84351 (65), 84352 (9), 84353 (3), 84354 (27), 84355 (4), 84356 (12), 84357 (3), 84358 (19); mainland: main pier at Trujillo, 84350 (1). BELIZE: BC, 86159 (2); BRG, 86078 (32), 86163 + 86175 (2); BRT, 86162 (16); CBC, 89287 (23), 89310 (7), 89324 (7), 89352 (34), 89367 (2), 89383 (1), 89397 (28); FC, 86173 (2); GR, 77530 (2), 77531 (1), 77532 (1), 77578 (15), 77579 (18); LR, 77577 (2), 77802 (36); SC, 86161 (1); TC, 86160 (2). Additional Belize material examined: CBC, JWC-11 (1); LR, UMML 9557; SWC, JWC-9 (1), JWC-24 (4).

Parablennius Riberio, 1915

According to Bath (1977), the genus *Parablennius* contains nine species, only one of which, *P. marmoreus*, occurs in the Caribbean Atlantic area.

(56) **Parablennius marmoreus** (Poey, 1875)

This species[4] has been reported from the Bahamas, Florida, Greater and Lesser Antilles, Trinidad, Venezuela, and the Gulf of Mexico. It has also been reported from the east coast of the United States as far north as New York (Cervigon, 1966; Böhlke & Chaplin, 1968; Randall, 1968; Mago, 1970; Smith, 1976; Bath, 1977). This is apparently the first record of this species for Belize and for the western Caribbean.

Ecological data.—Our single specimen of *P. marmoreus* was taken at Frenchman's Cay (Belize) in less than 7 ft of water in an area of mangrove roots (covered with an attached fauna of sponges and tunicates) and a soft mud bottom (H9). Three specimens of *Hypleurochilus aequipinnis* were taken at the same station (G 74-14).

Material examined.—A total of one specimen from one collection. BELIZE: FC, 86165 (1).

Scartella Jordan, 1886

According to Bath (1977) there are four (possibly five) species assignable to the genus *Scartella*, of which only one, *S. cristata*, occurs in the western Atlantic.

(57) **Scartella cristata** (Linnaeus, 1758)

This species is known from both sides of the Atlantic. In the western Atlantic it is known from Bermuda, the Bahamas, Florida, Greater and Lesser Antilles, and south to Brazil, Venezuela, and the Gulf of Mexico (Pinto, 1954; Cervigon, 1966; Böhlke & Chaplin, 1968; Randall, 1968; Mago, 1970). It has been reported from Catelonia Bay, Panama (Breder, reported in Meek & Hildebrand, 1928). This is apparently the first record for Belize and Honduras.

[4]C. R. Gilbert (personal communication) has informed us of the likelihood that more than one species is currently subsumed under this name.

Ecological data.—All of our records for *S. cristata* are from less than 10 ft of water, and five of seven records are from less than 5 ft of water. We have collected *S. cristata* on only one occasion in Belize [SC, G 74-16 (1)] in an area of coral rubble and algae (H5). We have collected *S. cristata* on five occasions at the Hog Islands (table 25) in areas of coral rubble and rock with or without adjacent scattered heads of live coral (H4, and H9 in the case of F 75-51, an exceptionally broad station). *Scartella cristata* was also taken from a pier piling at Trujillo on the mainland (H8). *Scartella cristata* was taken with four other blenniid species: *Entomacrodus nigricans* (CC only), *Hypleurochilus aequipinnis* (Trujillo pier only), *H. springeri* (CC only), and *Ophioblennius atlanticus macclurei* (CC, SC) (table 24). *Scartella cristata* shares highest affinity (GMI) values with *Labrisomus nuchipinnis* and *L. kalisherae*.

Material examined.—A total of 33 specimens from seven collections. HONDURAS: CC, 84564 (11), 84565 (4), 84566 (3), 84567 (1), 84568 (10); mainland: main pier at Trujillo, 84563 (3). BELIZE: SC, 86166 (1).

DISCUSSION

We have attempted to elucidate and study certain general patterns in the distribution of the 57 blennioid species we have collected in Belize and Honduras. We were particularly interested in (1) comparisons between localities directed toward quantifying observed inshore to offshore changes in the composition of blennioid species assemblages and in species richness, (2) determining the composition of groups of blennioid fishes that commonly co-occurred in our samples, (3) examining locality data for possible environmental correlates of the distribution of the groups recognized, and (4) examining the composition of the blennioid fauna of Belize and Honduras in terms of supposed broadscale distribution patterns of tropical western Atlantic shorefish species.

Comparisons Between Localities

Unevenness of sampling effort and especially the paucity of collections at inshore sites forced us to pool data prior to attempting comparisons between localities. We chose to group the 18 specific collecting sites (table 3) at which we captured blennioid species into six "general" localities, two in Honduras—(A) Hog Islands and (B) Roatan; one shared by Belize and Honduras—(C) mainland localities; and three in Belize—(D) cays inside of the Belize Barrier Reef, (E) Belize Barrier Reef sites, and (F) atolls. We refer to localities C and D as "inshore" localities; localities A, B, E, F as "offshore" localities. We have compiled species lists (based on all 127 stations) for each of the six general localities and determined the number of species shared for each of the 15 possible pairwise comparisons (table 26). These data allow computation of similarity coefficients (SI) for each of the pairwise comparisons, and values for the Jaccard Coefficient (table 26) are presented in rank order in Table 27.

Three of the general localities, (A) Hog Islands, (E) Belize Barrier Reef sites, and (F) atolls, stand out (tables 3, 26) in sharing three attributes: (1) the greatest total number of species (respectively, 38, 38, 39) were taken at these three localities, (2) the greatest proportion of sampling effort (107 of 127 stations) was expended at these three localities, and (3) the three highest totals for number of shared species and three largest shared SI values are represented in the three

TABLE 26. Similarity between various localities in Belize and Honduras based on numbers of shared species. Each "general locality" indicated includes the same specific sampling sites listed in Table 3, except that results for the Hog Islands and Roatan are given separately. The upper half of the matrix indicates number of shared species for each pair of localities. The lower half of the matrix gives calculated SI values for each pair (based on Jaccard Coefficient, see text for additional explanation).

Locality	N	Locality	A	B	C	D	E	F
A. Honduras: Hog Ids.	38	A	—	19	4	13	30	27
B. Honduras: Roatan	25	B	.43	—	3	10	19	20
C. Belize and Honduras: mainland localities	7	C	.10	.10	—	5	2	2
D. Belize: cays inside of Barrier Reef	16	D	.32	.32	.28	—	10	10
E. Belize: sites on Barrier Reef	38	E	.65	.43	.05	.23	—	32
F. Belize: atolls	39	F	.54	.46	.05	.22	.71	—

N = total number of species taken (based on all stations).

TABLE 27. Correspondence between calculated SI values for general localities in Belize and Honduras and the total number of stations occupied at each pair of localities. Localities are those defined in Table 26. The total number of stations (NST) is the summed total number of stations at each member of a pair of localities.

	Calculated SI values		Total number of stations	
Localities	SI	Rank	NST	Rank
E-F	.711	1	96	1
A-E	.652	2	38	6
A-F	.540	3	80	2
B-F	.455	4	77	3
A-B	.432	5.5	19	10
B-E	.432	5.5	35	7
B-D	.323	7	13	14
A-D	.317	8	16	12
C-D	.278	9	12	15
D-E	.227	10	32	9
D-F	.222	11	74	5
B-C	.103	12	15	13
A-C	.098	13	18	11
C-E	.047	14	34	8
C-F	.045	15	76	4

SI vs. NST, $Tau_{15} = 0.267$, $.10 < p < .20$.

possible comparisons between these localities (tables 26, 27). These facts might imply that SI values calculated in pairwise comparisons may directly reflect sampling effort. Given the unevenness of sampling effort represented in our data, this result would not be surprising but neither would it be of any biological interest. We tested for a direct relationship between SI values and sampling effort (measured by number of stations) over the 15 pairwise comparisons (table 27). The resulting tau value (Kendall's rank-correlation coefficient, corrected for

ties, see Tate & Clelland, 1957) is not statistically significant, $Tau_{15} = +0.267$, $.10 < p < .20$. We use this result to justify, with hesitation, further discussion.

There appears to be an inshore to offshore gradient in SI values, with the mainland locality clearly the most distinctive (fig. 6). The mainland locality (C) shares a moderately high SI value (0.278) only with locality (D) cays inside of the Belize Barrier Reef and shares very low SI values with the other localities (tables 26, 27). If these results are not explainable solely in terms of differences in sampling effort at different localities, two additional explanations come to mind: (1) that the inshore to offshore gradient in SI values reflects an inshore to offshore gradient in species richness (total number of blennioid species present), and (2) that the inshore to offshore gradient reflects changes in the species of blennioid fishes present at the different localities.

Both explanations are probably true. There is no doubt that many more species of blennioid fishes occur at the offshore, insular localities than occur at the inshore, continental localities we have sampled in Belize and Honduras. We are certain that additional sampling at the Hog Islands and at Roatan would increase the SI values shared by each with each other and with the offshore localities in Belize (*e.g.*, there was only one station each at the Hog Islands and at Roatan in which sampling extended to depths greater than 20 ft). We greatly doubt, however, that additional sampling would substantially increase the SI values shared by the mainland and offshore localities. This is particularly true for Belize where the entire mainland coast is fringed by mangrove swamps.

In addition to the apparent inshore to offshore gradient in species richness there is also some evidence for changes in species actually present along the inshore to offshore axis. For example, despite the great expenditure of sampling effort at offshore (Barrier Reef + atolls) sites in Belize (76% of all stations, 91% of all Belize stations), seven species taken at mainland sites and/or sites at cays behind the Barrier Reef were never taken at Barrier Reef sites or at the atolls. The seven species are as follows: (6) *Labrisomus kalisherae*, (11) *Malacoctenus delalandei*, (18) *Paraclinus fasciatus*, (52) *Hypleurochilus aequipinnis*, (54) *Lupinoblennius dispar*, (56) *Parablennius marmoreus*, and (57) *Scartella cristata*. Were it not for one record (and one specimen) from the Barrier Reef at BRG, (27) *Starksia occidentalis* would be a member of this group. All of these species (except *Parablennius marmoreus*, represented in our collections by a single specimen) were also taken at Roatan or the Hog Islands or both. *Lupinoblennius dispar* is unique among the 57 species reported in this paper in that it was taken only at mainland localities and only in brackish water or freshwater.

These results support our belief that part of the inshore to offshore gradient in SI values is related to changes in blennioid species actually occurring at different sites along the inshore to offshore axis. This would be in general agreement with discussions of the continental vs. insular shorefish faunas provided by Gilbert & Kelso (1971), Robins (1972), and Gilbert (1973).

Part of the explanation for the trend in species richness and for changes in the composition of blennioid assemblages along the inshore to offshore axis might relate to differences in diversity of available habitats along the inshore to offshore axis. Unfortunately, given the distribution of sampling effort represented in our collections (table 4), any attempt to test this suggestion will depend on our opportunity to considerably broaden our collection base, particularly at inshore sites.

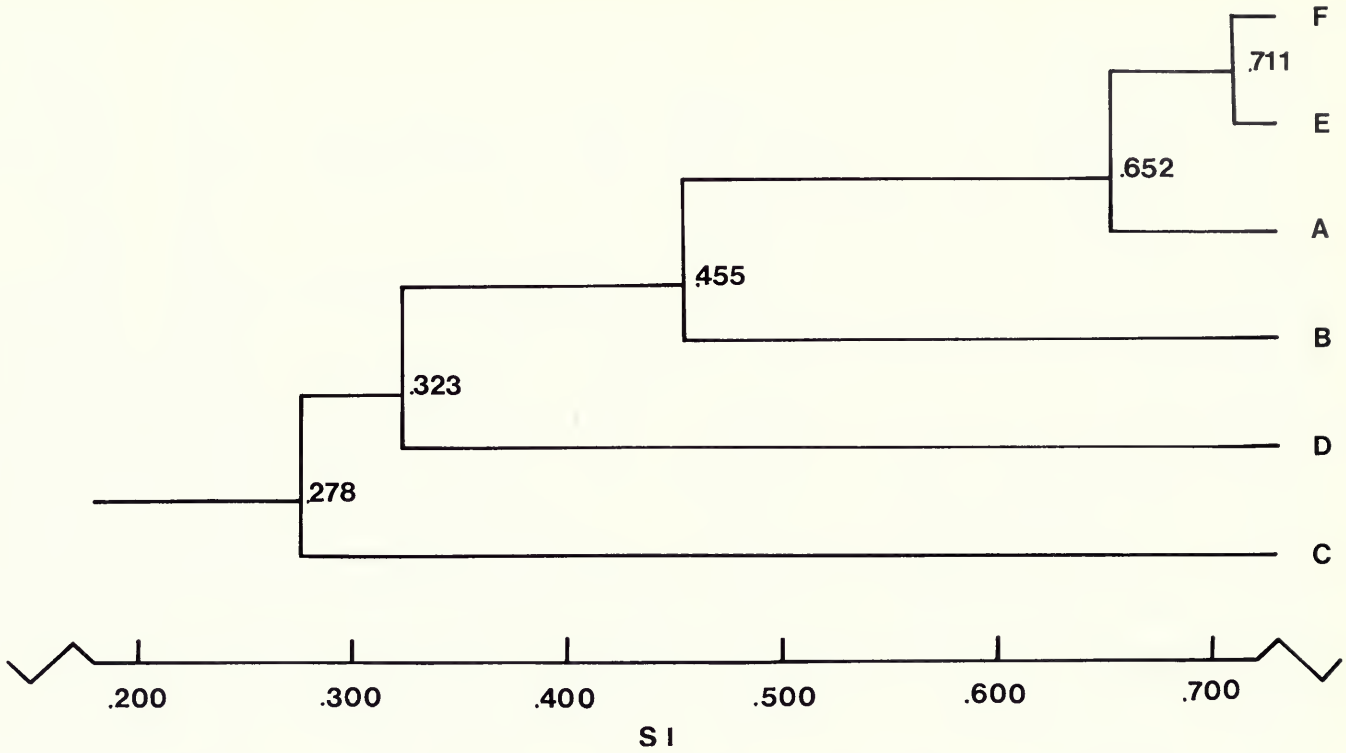

FIG. 6. Relationship between six general localities (table 26) in Belize and Honduras based on single-linkage clustering of SI values (Jaccard Coefficient). A = Hog Islands (Honduras); B = Roatan (Honduras); C = mainland sites (Belize and Honduras); D = Belize, cays behind the Barrier Reef; E = Belize, sites at Barrier Reef; and F = Belize, atolls.

Recurrent Group Analysis

Our usage of recurrent group analysis had two purposes: (1) to determine the composition of groups of blennioid fishes that commonly co-occurred in our samples, and (2) to provide a basis for examination of locality data for those stations at which a large proportion of the members of a recurrent group were taken to determine possible environmental features (site, depth, substrate, etc.) associated with the distribution of the groups formed by the analysis. In attempting to determine groups of "associated" blennioid fishes in Belize and Honduras, *i.e.*, groups of species "commonly" taken together in the same station, we had to choose between using presence and absence data or abundance data (number of individuals/station, either absolute or by rank) or both. Much of the recent work on fish associations in which attempts have been made to determine the composition of groups of associated species (or species similar in habitat requirements) have depended on the use of abundance data (representative examples: Clarke, 1977; Ebeling et al., 1970; Echelle & Schnell, 1976; Smith & Powell, 1971). There is enormous potential for bias on a station-to-station basis in broadcast ichthyocide collecting, and possible (in fact likely) bias in our data was compounded because the initial purpose of collecting efforts in Belize was faunistic rather than ecological (resulting in, among other things, the likelihood of under-representation of "common" species in our samples). For these reasons we felt that the use of a grouping strategy based on presence and absence data was likely to be more reliable in the present study. Our use of abundance data in a subsequent section of this discussion is on a pooled-sample basis rather than on a station-to-station basis.

The recurrent group method (Fager, 1957; Fager & McGowan, 1963; Fager & Longhurst, 1968; Hayes, 1978) is based on presence and absence data. It has the advantage of being definable and repeatable. The groups formed contain the largest possible number of species, all members of which share a minimum (pre-established and arbitrary) level of "affinity" (GMI value in the case of this paper). The basic datum for the recurrent group method is the presence or absence of a particular species at a particular station. Thus the method has the disadvantage of being severely influenced by the method(s) of sampling employed, the distribution of sampling effort (among collecting sites, depth zones, habitat categories, etc.), the dichotomous index of affinity chosen (here the GMI), and the pre-established minimum index value chosen as the breakpoint for testing affinity. Note that disadvantages relating to sampling technique and distribution of sampling effort apply to any grouping strategy chosen. Although Fager (1957) discusses analytical techniques for studying co-occurrence based on numbers of individuals taken, these techniques, in recurrent group analysis, are based on the results of the analysis and not the reverse.

Recurrent group analyses were performed for data based on Glovers Reef samples only, Belize samples only, and Belize and Honduras samples. Only Class I stations were included in the analysis. We report on results for runs at three pre-established affinity levels (GMI = 0.500, GMI = 0.400, GMI = 0.300) but discuss in detail only those groups formed at GMI = 0.300. Recurrent groups formed at GMI = 0.300 are indicated in Figures 7, 8, and 9. Recurrent groups formed at higher pre-established affinity levels are listed in Table 28.

Recurrent groups based on Belize and Honduras data.—At GMI = 0.300 it is possible to form four recurrent groups (fig. 7) with a total of 23 species (plus two

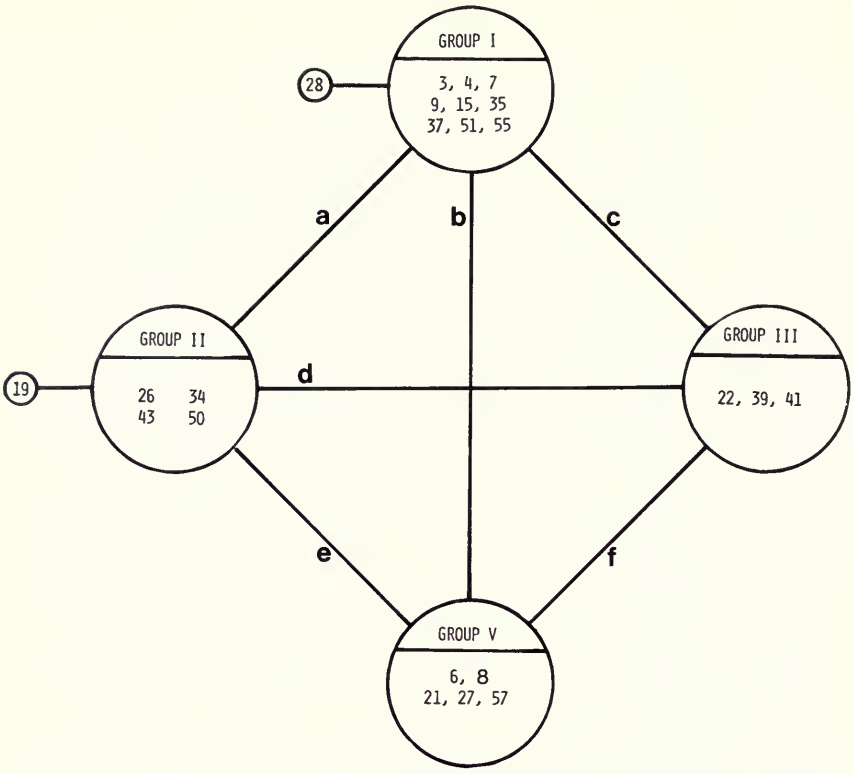

FIG. 7. The composition of recurrent groups of blennioid species from Belize and Honduras, based on all Class I stations (N = 104). Small satellite circles indicate associates (see text for additional explanation). Lines linking the groups (large circles) show intergroup connections with level of connection (keyed to letters as listed below) indicated by ratio of observed species-pair connections (at or above GMI = 0.300) to the maximum possible number of such connections: a = 0/36, b = 20/45, c = 7/27, d = 0/12, e = 0/20, and f = 0/15.

associated[5] species) based on the 104 Class I stations at which blennioid fishes were taken in Belize and Honduras.

GROUP I

Members: (3) *Labrisomus gobio,* (4) *L. guppyi,* (7) *L. nigricinctus;* (9) *Malacoctenus aurolineatus,* (15) *M. triangulatus;* (35) *Enneanectes boehlkei,* (37) *E. pectoralis;* (51) *Entomacrodus nigricans;* (55) *Ophioblennius atlanticus macclurei.*

Associated species: (28) *Starksia sluiteri.*

All nine members of Group I were taken at three stations [CBC (2), GR (1)], all in shallow water (less than 15 ft). Only one habitat category was represented (H2). Six, seven, or eight members of Group I were taken at 12 additional stations [BRG (2), BRT (1), CBC (1), LR (2), CC (5), IR (1)], all in shallow water (less than 18 ft, 11 of 12 stations in less than 10 ft). Four habitat categories were

[5]Species associated with a recurrent group exhibit affinity (established by GMI value) exclusively with some (not all) members of that group.

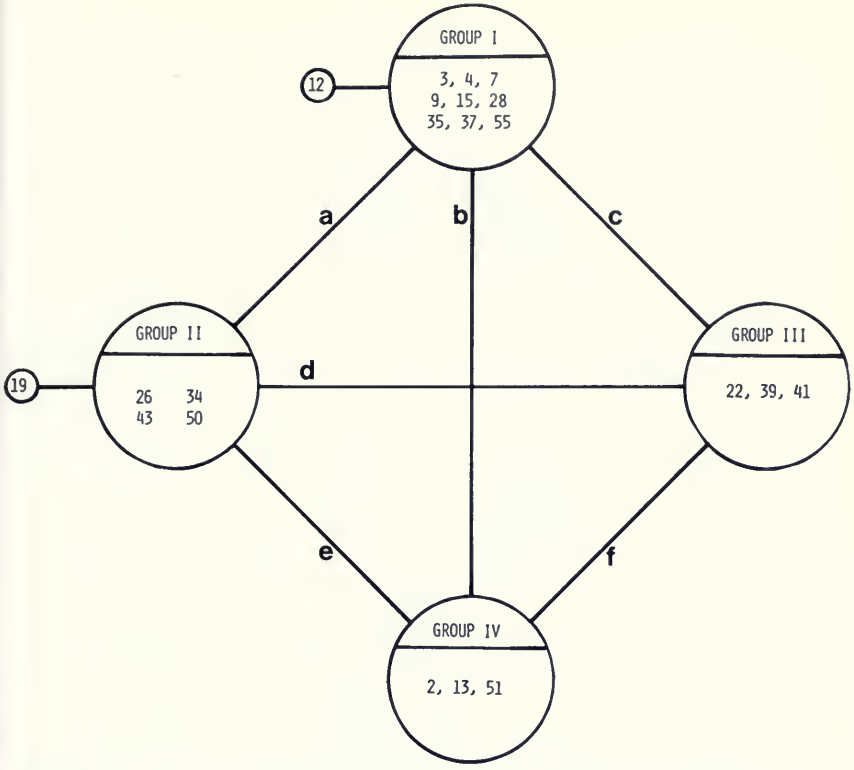

FIG. 8. The composition of recurrent groups of blennioid fishes based on Belize data only (number of Class I stations = 83). Other symbols as in Figure 7. Key to intergroup connections: a = 0/36, b = 7/27, c = 9/27, d = 0/12, e = 0/12, and f = 0/9.

represented [H2 (7), H3 (1), H4 (3), H9 (1)]. The station (F 75-51) classed H9 was at the Hog Islands in an area with substrates corresponding to H2 and H4 habitat categories well-represented.

At the affinity level GMI = 0.500, most of the members of Group I formed one of two groups labeled (table 28) Group I-A and Group I-B. Three or more members of Group I-A occurred at 28 stations, all in shallow water (less than 20 ft, 23 of 28 in less than 10 ft), with most records (22 of 28) from stations classed H2 (15) or H3 (7). Two or more members of Group I-B occurred at 14 stations, all in shallow water (less than 18 ft, 12 of 14 in less than 10 ft), with most records (9 of 14) from stations classed H2. As a group, Group I-B was never taken in patch reef (H3) habitats.

At the affinity level GMI = 0.400, all Group I species except (3) *Labrisomus gobio* form a recurrent group (table 28).

GROUP II

Members: (26) *Starksia nanodes*, (34) *Enneanectes atrorus*, (43) *Emblemaria caldwelli*, (50) *Lucayablennius zingaro*.

Associated species: (19) *Paraclinus infrons*.

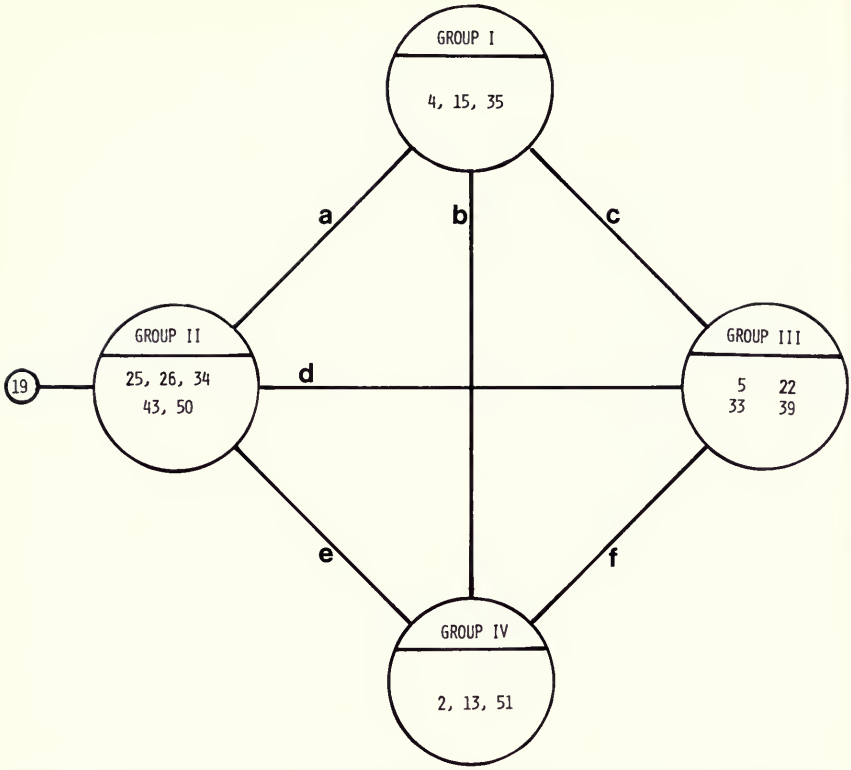

FIG. 9. The composition of recurrent groups of blennioid fishes based on Glovers Reef data only (number of Class I stations = 42). Other symbols as in Figure 7. Key to intergroup connections: a = 0/15, b = 0/9, c = 2/12, d = 3/20, e = 0/15, and f = 0/12.

All four members of this group were taken at four stations, all at Glovers Reef, all at depths exceeding 50 ft, all in H1 habitats. Three of the four members of Group I were taken at eight additional stations [CBC (2), GR (5), IR (1)], all at depths exceeding 45 ft, all in H1 habitats.

None of the members of Group II formed part of a recurrent group at GMI = 0.500. Three of the four members of Group II form a recurrent group at GMI = 0.400 (table 28).

GROUP III

Members: (22) *Starksia atlantica*, (39) *Acanthemblemaria greenfieldi*, (41) *A. spinosa*.

All three members of Group III were taken at five stations [CBC (3), GR (2)], all in shallow water (less than 15 ft). Two habitat categories were represented [H3 (4), H9 (1)]. The station (G 78-6) classed H9 was at Carrie Bow Cay on and behind (leeward to) the reef crest, with substrates corresponding to H2 and H3 habitat categories well represented. Two of the three members of Group III were taken at 10 additional stations [CBC (5), GR (5)], all in shallow water (less than 15 ft). Two habitat categories were represented [H2 (3), H3 (7)].

No member of Group III was part of any group formed at GMI = 0.500 or GMI = 0.400.

TABLE 28. Recurrent groups of blennioid fishes formed at required levels of GMI = 0.400 or GMI = 0.500. See text for additional explanation.

GMI level	Group	Content (Belize and Honduras)	Content (Belize only)	Content (Glovers Reef only)
0.500	I	I-A: 4, 15, 35, 37, 55 I-B: 7, 9, 51 Associated = 12	4, 35, 37, 55	No groups formed at this level
0.400	I	4, 7, 9, 15, 35, 37, 51, 55	4, 15, 35, 37, 55	4, 15, 35
	II	26, 34, 50	26, 34, 50 Associated = 25	25, 34, 43, 50 Associated = 19, 26
	III	No group formed	22, 39, 41	22, 33, 39 Associated = 5

Group IV

The group of species (2, 13, 51) herein referred to as Group IV formed a recurrent group only when Honduras data were excluded from the analysis. Discussion of Group IV is deferred to results for runs based on Belize data only.

Group V

Members: (6) *Labrisomus kalisherae,* (8) *L. nuchipinnis,* (21) *Paraclinus nigripinnis,* (27) *Starksia occidentalis,* (57) *Scartella cristata.*

All five members of Group V were taken at five stations [SC (1), CC (4)], all in shallow water (less than 10 ft). Three habitat categories were represented [H4 (3), H5 (1), H9 (1)]. The station classed H9 was at the Hog Islands in an area with substrates corresponding to H2 and H4 habitat categories well represented. Three or four members of Group V were taken at three additional stations [BC (1), TC (1), CC (1)], all in shallow water (less than 5 ft). Two habitat categories were represented [H4 (1), H5 (2)].

No member of Group V was part of any recurrent group formed at GMI = 0.500. At GMI = 0.400 four recurrent groups are possible [(a) 6, 8, 21; (b) 6, 8, 57; (c) 6, 21, 27; (d) 8, 13, 21] of which three (a, c, d) are equally acceptable in that in each case all three species were taken at a total of seven stations. Of the six species represented in these four groups, only one species, (13) *Malacoctenus gilli,* is not recognized as a member of Group V.

Recurrent groups based on Belize data.—At GMI = 0.300, it is possible to form four recurrent groups (fig. 8) with a total of 22 species (plus two associated species) based on the 83 Class I stations at which blennioid fishes were taken in Belize. Groups I, II, and III thus formed are identical in composition with groups based on the total (Belize + Honduras) data except that species (51) *Entomacrodus nigricans* is replaced by (28) *Starksia sluiteri* as a member of Group I (cf. figs. 7, 8). Two equally acceptable groups [(a) 6, 8, 21; (b) 6, 21, 27] corresponding to Group V (fig. 7) can be formed from the Belize data. In each case (a and b) all three species were taken at three stations, the same three stations: G 74-11, BC, 0 to 4 ft, H5; G 74-15, TC, 0 to 3 ft, H5; G 74-16, SC, 0 to 5 ft, H5.

Group IV

Members: (2) *Labrisomus bucciferus,* (13) *Malacoctenus gilli,* (51) *Entomacrodus nigricans.*

All three members of Group IV were taken at six stations [Belize only: BRT (1), CBC (1), GR (3), LR (1)], all in less than 4 ft of water. Two habitat categories were represented [H2 (3), H6 (3)]. Two of the three members of Group IV were taken at four additional stations [Belize only: CBC (1), GR (3)], all in less than 4 ft of water. Four habitat categories were represented [H2 (1), H3 (1), H6 (1), H9 (1)]. The station (G 74-2) classed H9 was at Glovers Reef in less than 2 ft of water. This station should probably be classed H6, but complete habitat information was not recorded by the collectors.

Group IV was formed only in those runs in which Honduras data were excluded (cf., figs. 7 vs. 8, 9). This group may represent an artifact, a failing of the methodology, in that species (51) *Entomacrodus nigricans* would join Group I (as based on Belize data only) were it not for the low affinity level (GMI = 0.299, just below the required 0.300) shared with just one Group I species: (15) *Malacoctenus triangulatus.* The GMI value shared by this pair is 0.472 for Belize +

Honduras data, and 0.000 for Glovers Reef data (the two were taken together at only one Glovers Reef station). Because of the apparent high association (relative to sampling effort) of this group with very shallow reef-crest intertidal or immediately subtidal pools (H6), we choose to recognize Group IV as a separate group for purposes of discussion in this paper.

Recurrent groups based on Glovers Reef data.—At GMI = 0.300, it is possible to form four recurrent groups (fig. 9) with a total of 15 species (plus one associated species) based on the 42 Class I stations at which blennioid fishes were taken at Glovers Reef.

Based on Glovers Reef data only three species corresponding to Group I formed a recurrent group, *viz.*, (4) *Labrisomus guppyi*, (15) *Malacoctenus triangulatus*, (35) *Enneanectes boehlkei*. Two or three members of this group were taken at five Glovers Reef stations, all in less than 15 ft. Two habitat categories are represented [H2 (2), H3 (3)].

In the run restricted to Glovers Reef data five species corresponding to Group II formed a recurrent group, *viz.*, (25) *Starksia lepicoelia*, (26) *S. nanodes*, (34) *Enneanectes atrorus*, (43) *Emblemaria caldwelli*, (50) *Lucayablennius zingaro*, with (19) *Paraclinus infrons* as an associated species. Three or more members of this group were taken at a total of 11 Glovers Reef stations, all at depths exceeding 50 ft. Only one habitat category (H1) was represented.

Four species corresponding to Group III formed a recurrent group based on Glovers Reef data, *viz.*, (5) *Labrisomus haitiensis*, (22) *Starksia atlantica*, (33) *Enneanectes altivelis*, (39) *Acanthemblemaria greenfieldi*. Three or four members of this group were taken at a total of seven Glovers Reef stations, all at depths less than 20 ft. Only one habitat category (H3) was represented.

Group IV as formed from Glovers Reef data (fig. 9) is identical to Group IV based on all Belize data (fig. 8). All three members of Group IV were taken at three Glovers Reef stations, all in less than 4 ft of water, from stations representing only one habitat category (H6). Two of the three members of Group IV were taken at three additional Glovers Reef stations, all in less than 4 ft of water. Three habitat categories were represented [H3 (1), H6 (1), H9 (1)]. The station (G 74-2) classed H9, in less than 2 ft of water, should probably be classed H6, but complete habitat information was not recorded by the collectors.

Only two of the five species assigned to Group V (fig. 7) were taken at Glovers Reef—species 8 and 21—and neither species is part of any recurrent group formed on the basis of Glovers Reef data alone.

Summary of composition of recurrent groups.—Based on the three sets of analyses (Belize + Honduras, Belize only, Glovers Reef only) we choose to recognize, for purposes of further discussion, five groups of blennioid fishes from Belize and Honduras:

Group I —8 species (3, 4, 7, 9, 15, 35, 37, 55)
Group II —4 species (26, 34, 43, 50)
Group III—3 species (22, 39, 41)
Group IV—3 species (2, 13, 51)
Group V —5 species (6, 8, 21, 27, 57)

Groups I, II, III, and V are identical to the foregoing definition (fig. 7) except, for reasons discussed elsewhere, species (51) *Entomacrodus nigricans* is excluded

from Group I and recognized as a member of Group IV. Group IV is defined in the two preceding sections (Belize data only, Glovers Reef data only). We realize that we are departing from normal procedure in recognition of five groups based on three separate sets of analysis, but we believe that distributional information and analysis detailed below justifies this departure. All subsequent discussion is based on the five groups as defined in this paragraph.

Analyses based on pooled data.—The results of the recurrent group analysis are summarized in Tables 29, 30, and 31. Table 29 gives the number of stations at which 60% or more of the members of the indicated groups were taken with respect to the nine habitat categories and the six geographic localities defined in Table 26. None of the groups occurred (as a group) at any mainland station, and only Group V was found to occur as a group at cays inside the Barrier Reef. Each group is distinctive in the habitat category or categories at which it was best represented.

Capture data (based on Class I stations only) for the 23 species included in the five recognized groups is summarized in Tables 30 and 31. In all cases the number of records and proportion of individuals given is based on all 104 Class I stations, despite the fact that Group IV was formed from Belize data only. Justification for this is provided by the concordance calculations discussed below.

One result that stands out, especially in the cases of Groups I and V (table 30), is the remarkable success of our sampling efforts at the Hog Islands. Relative to effort expended—Hog Island stations account for 11 of 104 Class I stations—the number of individuals of Group I and Group V species taken at the Hog Islands is very large. The same is true for one or two species included in Group IV. Equally large were the total number of species (species richness) represented at several Hog Island stations. Of the 127 collections on which this paper is based, only 20 collections contained 10 or more blennioid species, and eight of these were at Hog Island stations. A total of 23 blennioid species was taken at one Hog Island station (F 75-51), and totals of 19 species each were taken at two additional Hog Island stations. There three stations are the richest in terms of numbers of species taken of any of the 127 stations in Belize and Honduras at which blennioid species were taken.

There are a number of factors contributing to the richness of the Hog Island stations: (1) all were obtained by a field party of up to six persons, all with extensive experience in collecting (many of the Belize collections were obtained by a field party of only two persons), (2) all of the richest collections were in shallow water (less than 20 ft), allowing time to obtain very large samples, and (3) the geography of collecting sites at the Hog Islands was such that a number of Hog Island stations were in areas exhibiting a richer variety of habitats than at any site visited by us in Belize; *e.g.*, at two sites in the Hog Islands (F 75-47, F 75-51), collecting ranged from rocky ledges, cobble, and rubble inshore to small but richly developed coral formations offshore. This mixture of habitat types was most pronounced at the two stations listed but was more or less true for a number of other shallow-water Hog Island stations. Both the Hog Islands and Roatan are "high" rocky islands and are without parallel in Belize. All of this would seem to contribute to a possible explanation for the fact that a number of species taken together at Hog Island stations were never taken together in Be-

TABLE 29. Captures (number of stations) of recurrent groups with respect to habitat categories and geographic localities, based on those stations at which 60% or more of the members of a recurrent group were taken. Geographic localities as in Table 26. Based on Class I stations only. Recurrent group membership as defined in text.

	Habitat categories									Geographic localities						Number of
Group	H1	H2	H3	H4	H5	H6	H7	H8	H9	C	D	E	F	A	B	stations (total)
I	—	10	1	3	—	—	—	—	1	—	—	6	3	5	1	15
II	12	—	—	—	—	—	—	—	—	—	—	2	9	—	1	12
III	—	3	11	—	—	—	—	—	1	—	—	8	7	—	—	15
IV*	—	4	1	—	—	4	—	—	1	—	—	3	7	—	—	10
V	—	—	—	4	3	—	—	—	1	—	3	—	—	5	—	8

*Based on Belize data only.

TABLE 30. Captures of species assigned to five recurrent groups at six geographic localities in Belize and Honduras. Groups I, II, III, and V as in Figure 7; Group IV as in Figure 8 (note the exclusion of (51) *Entomacrodus nigricans* from Group I and its inclusion with Group IV). Localities as in Table 26. Data presented as proportion of total individuals captured (decimal fractions) and number of records (whole numbers, in parentheses). Based on Class I stations only (104 stations total).

Species	N_S	N_I	C. Mainland localities		D. Cays inside Barrier Reef		E. Barrier Reef		F. Atolls		A. Hog Islands		B. Roatan	
GROUP I														
3	48	10	—	—	—	—	.60	(5)	.35	(4)	—	—	.04	(1)
4	270	29	—	—	—	—	.43	(12)	.23	(8)	.22	(7)	.11	(2)
7	41	13	—	—	—	—	.66	(7)	.12	(2)	.20	(3)	.02	(1)
9	173	12	—	—	—	—	.39	(5)	.03	(3)	.57	(4)	—	—
15	253	31	—	—	.02	(3)	.19	(8)	.12	(6)	.53	(9)	.14	(5)
35	183	29	—	—	—	—	.36	(12)	.26	(8)	.35	(7)	.03	(2)
37	87	20	—	—	.05	(2)	.60	(8)	.16	(3)	.15	(6)	.05	(1)
55	377	30	.00	(1)	.02	(4)	.45	(11)	.15	(6)	.38	(8)	—	—
GROUP II														
26	57	20	—	—	—	—	.53	(6)	.37	(12)	.04	(1)	.07	(1)
34	38	16	—	—	—	—	—	—	.89	(15)	—	—	.11	(1)
43	67	14	—	—	—	—	.27	(3)	.73	(11)	—	—	—	—
50	78	24	—	—	—	—	.19	(6)	.72	(16)	.03	(1)	.06	(1)
GROUP III														
22	70	22	—	—	—	—	.56	(12)	.43	(9)	—	—	.01	(1)
39	63	15	—	—	—	—	.71	(9)	.29	(6)	—	—	—	—
41	20	10	—	—	—	—	.45	(5)	.20	(3)	.35	(2)	—	—
GROUP IV														
2	92	16	—	—	—	—	.29	(4)	.51	(7)	.05	(2)	.13	(3)
13	154	21	—	—	.04	(2)	.06	(5)	.29	(7)	.29	(5)	.32	(2)
51	353	20	—	—	—	—	.07	(5)	.31	(7)	.59	(7)	.03	(1)
GROUP V														
6	196	11	—	—	.88	(4)	—	—	—	—	.12	(7)	—	—
8	71	16	.06	(1)	.11	(3)	.39	(4)	.06	(2)	.38	(6)	—	—
21	121	14	—	—	.28	(3)	—	—	.26	(3)	.42	(5)	.04	(3)
27	53	14	—	—	.11	(4)	.02	(1)	—	—	.77	(8)	.09	(1)
57	33	7	.09	(1)	.03	(1)	—	—	—	—	.88	(5)	—	—

N_S = total number of individuals captured; N_I = number of Class I records.

TABLE 31. Captures with respect to habitat categories of species assigned to five recurrent groups. Groups and data presentation as in Table 30.

Species	N_S	N_1	H1	H2	H3	H4	H5	H6	H7	H8	H9
GROUP I											
3	48	10	— —	.94 (8)	.06 (2)	— —	— —	— —	— —	— —	— —
4	270	29	— —	.70 (16)	.16 (9)	.08 (2)	— —	— —	— —	— —	.06 (2)
7	41	13	— —	.78 (9)	.02 (1)	.12 (2)	— —	.07 (1)	— —	— —	— —
9	173	12	— —	.42 (7)	— —	.46 (3)	— —	.01 (1)	— —	— —	.12 (1)
15	253	31	.01 (1)	.37 (11)	.12 (7)	.28 (4)	.02 (3)	— —	.01 (2)	— —	.19 (3)
35	183	29	— —	.44 (14)	.26 (9)	.18 (3)	— —	— —	— —	— —	.11 (3)
37	87	20	— —	.72 (11)	.17 (3)	.05 (3)	.05 (2)	— —	— —	— —	.01 (1)
55	377	30	— —	.67 (15)	.03 (5)	.23 (3)	.02 (4)	— —	— —	.00 (1)	.04 (2)
GROUP II											
26	57	20	.79 (16)	.12 (1)	.09 (3)	— —	— —	— —	— —	— —	— —
34	38	16	1.0 (16)	— —	— —	— —	— —	— —	— —	— —	— —
43	67	14	1.0 (14)	— —	— —	—	— —	— —	— —	— —	— —
50	78	24	1.0 (24)	— —	— —	— —	— —	— —	— —	— —	— —
GROUP III											
22	70	22	.03 (2)	.43 (8)	.53 (11)	— —	— —	— —	— —	— —	.01 (1)
39	63	15	— —	.52 (4)	.43 (10)	— —	— —	— —	— —	— —	.05 (1)
41	20	10	— —	.05 (1)	.55 (6)	.35 (2)	— —	— —	— —	— —	.05 (1)
GROUP IV											
2	92	16	— —	.33 (4)	.02 (2)	.04 (1)	.01 (1)	.40 (4)	.13 (2)	— —	.07 (2)
13	154	21	— —	.06 (5)	.01 (1)	.18 (3)	.06 (4)	.37 (5)	.32 (2)	— —	.01 (1)
51	353	20	— —	.12 (10)	.01 (1)	.46 (4)	— —	.30 (4)	— —	— —	.11 (1)
GROUP V											
6	196	11	— —	.02 (2)	— —	.10 (4)	.88 (4)	— —	— —	— —	.01 (1)
8	71	16	— —	.03 (2)	— —	.32 (4)	.48 (5)	.08 (2)	— —	.06 (1)	.03 (2)
21	121	14	— —	.02 (2)	— —	.21 (3)	.28 (3)	.21 (2)	.03 (2)	— —	.25 (2)
27	53	14	.11 (1)	.28 (5)	— —	.32 (3)	.11 (4)	— —	— —	— —	.17 (1)
57	33	7	— —	— —	— —	.85 (4)	.03 (1)	— —	— —	.09 (1)	.03 (1)

lize. For example, *Labrisomus kalisherae* was taken with 14 other blennioid species only at Hog Island stations (2, 4, 5, 7, 9, 12, 33, 35, 41, 46, 47, 49, 51, 53—this list does not include species that were only taken at Hog Island stations). A number of similar examples could be found.

Our purpose in conducting recurrent group analysis was to find, for the blennioid species included in this paper, groups of species commonly taken together, in Fager's (1957) words, ". . . species which very frequently form a part of each other's environment." Our unit of sampling is the station or collection—a broadcast method that may well result in the grouping of species that occupy strikingly distinctive microhabitats. One possible example of this is indicated in the discussion of (51) *Entomacrodus nigricans*. Another seemingly good example is the case of (39) *Acanthemblemaria greenfieldi* and (41) *A. spinosa*, which with (22) *Starksia atlantica* form Group III. Adults of the two species of *Acanthemblemaria* occupy strikingly different (yet closely adjacent) microhabitats (Greenfield & Greenfield, in press) yet are commonly taken together in the same sample. Thus, the scale of sampling is relatively coarse, and the results must be so interpreted.

With due knowledge of the coarseness of the groupings obtained through the recurrent group analysis, we were interested in determining the level of concordance among species belonging to a recurrent group with respect to captures tabulated by geographic localities and habitat categories. We follow Fager (1957) and Fager & McGowan (1963) in using numbers of individuals taken in determining this concordance; however, the uneven distribution of sampling effort (tables 3, 4) as well as biases inherent in our sampling methods suggested that ranking within species on a station by station basis, as done by Fager (1957, p. 593), would not produce interpretable results. Rather we tested for concordance (Kendall's coefficient of concordance, W, corrected for ties, see Tate & Clelland, 1957) among the species of a recurrent group based on the pooled data presented in Tables 30 and 31. For each species within each group we ranked captures (total number of individuals taken at Class I stations) over the six geographic localities (table 30) and nine habitat categories (table 31) and then calculated the level of concordance among the species forming the group. We are well aware of the possible, in fact probable, effects that differences in sampling effort among the six geographic localities and nine habitat categories might have had on our results. Our sole purpose in making these calculations was to determine whether or nor there existed a statistical basis for a discussion of apparent differences in distribution among the five groups with respect to the geographic localities and habitat categories. The results (table 32) show very high levels of concordance in every case. We interpret this to mean that within the recurrent groups as defined in this paper rank-abundance (based on pooled data) within species at a given geographic locality or for a given habitat category tends to remain the same from species to species. This result would be expected for species supposedly forming a recurrent group. The very high concordance levels (table 32) between the members of recurrent groups allows further pooling of the data by geographic locality (table 33) and habitat category (table 34). The results are summarized below for each group.

Group I.—The species forming Group I are primarily associated with offshore, shallow-water, coral-rich habitats. Fifty-eight percent of all Group I specimens

TABLE 32. Calculated concordance values, W, for species belonging to five recurrent groups. Based on data given in Tables 30 and 31. See text for additional explanation.

Group	Basis for concordance calculation	M	N	W	Significance
I	Geographic areas	8	6	.80	**
	Habitat categories	8	9	.74	**
II	Geographic areas	4	6	.78	**
	Habitat categories	4	9	.81	**
III	Geographic areas	3	6	.81	**
	Habitat categories	3	9	.79	**
IV	Geographic areas	3	6	.73	*
	Habitat categories	3	9	.74	**
V	Geographic areas	5	6	.58	**
	Habitat categories	5	9	.64	**

KEY: M = number of species.
N = number of geographic areas (6) or habitat categories (9).
* = statistically significant at $.01 < p < .05$.
** = statistically significant at $p < .01$.

were taken at stations classed H2 (table 34), and 10 of 15 records for the group (table 29) are from stations classed H2. In Belize 98% of all Group I specimens were collected at offshore sites, either at the Barrier Reef or the atolls (table 33). The rather high intergroup connection between Group I and Group V (fig. 7) is almost entirely the result of broad collections in mixed habitats at the Hog Islands.

Group II.—The species forming Group II are associated with offshore (insular), deep-water, coral-rich habitats. Virtually all (> 90%) Group II specimens are from stations in depths exceeding 45 ft. Ninety-five percent of all Group II specimens were taken at stations classed H1 (table 34), and 12 of 12 records for the group (table 29) are from stations classed H1. In Belize 100% of all Group II specimens were taken at offshore sites, either at the Barrier Reef or the atolls (table 33).

Group III.—The species forming Group III are primarily associated with offshore, shallow-water, coral-rich habitats. Ninety-one percent (table 34) of all Group III specimens were taken at stations classed H2 (42%) or H3 (49%). Most records (11 of 15) for Group III as a group are from stations classed H3 (table 29). In Belize 100% of all Group III specimens were taken at offshore sites, either at the Barrier Reef or the atolls (table 33).

Group IV.—Group IV could be formed only in those runs in which Honduras data was excluded, due in large part, we believe, to the diverse range of habitats represented at a number of Hog Island stations. In Belize 184 of 267 (69%) Group IV specimens were taken at stations classed H6. Stations classed H6 accounted for only 6% of the 83 Class I stations in Belize. As a group (Belize data only) Group IV was equally represented at stations classed H2 and H6 (table 29), but all three members of Group IV were taken together only at stations classed H6. In Belize 97% of all Group IV specimens were taken in less than 4 ft of water. In Belize 97% of all Group IV specimens were taken at offshore sites, either at the

TABLE 33. Pooled capture data for five recurrent groups of blennioid fishes categorized by geographic locality. Based on data given in Table 30. Values for each group for each locality given as proportion of total specimens (N_S). See text for additional explanation.

Group	N_S	C. Mainland localities	D. Cays inside Barrier Reef	E. Barrier Reef	F. Atolls	A. Hog Islands	B. Roatan
A. BELIZE AND HONDURAS							
I	1,432	.001	.01	.40	.17	.36	.06
II	240	—	—	.26	.67	.02	.05
III	153	—	—	.61	.34	.05	.01
IV	599	—	.01	.10	.34	.43	.12
V	474	.01	.47	.06	.07	.36	.02

Group	N_S	C. Mainland localities	D. Cays inside Barrier Reef	E. Barrier Reef	F. Atolls
B. BELIZE (ONLY)					
I	834	.01	.02	.69	.29
II	223	—	—	.28	.72
III	145	—	—	.64	.36
IV	267	—	.02	.22	.75
V	292	.02	.76	.10	.12

TABLE 34. Pooled capture data for five recurrent groups of blennioid fishes tabulated with respect to habitat category. Based on data given in Table 31. Values for each group for each locality given as proportion of total specimens (N_S). See text for additional explanation.

Group	N_S	H1	H2	H3	H4	H5	H6	H7	H8	H9
I	1,432	.002	.58	.11	.21	.01	.003	.002	.001	.09
II	240	.95	.03	.02	—	—	—	—	—	—
III	153	.01	.42	.49	.05	—	—	—	—	.03
IV	599	—	.13	.01	.33	.02	.34	.10	—	.08
V	474	.01	.05	—	.24	.52	.07	.01	.01	.09
Effort (Class I stations)	104	.29	.18	.18	.04	.06	.06	.05	.07	.08

Barrier Reef or the atolls (table 33). In Belize, therefore, this group appears to be primarily associated with very shallow, reef-crest, intertidal pools or adjacent subtidal areas.

Group V.—The species forming Group V are apparently associated with more inshore (but not mainland), shallow-water habitats and are not strongly associated with richly developed coral reefs. Eighty-six percent (table 34) of all Group V specimens were taken at stations classed H4 (24%) or H5 (52%). Stations classed H4 or H5 account respectively for only 4% and 6% of the total 104 Class I stations. Only 6% of all Group V specimens came from stations classed H1, H2, or H3, despite the fact that stations classed as one of these three account for 65% of the 104 Class I stations. No Group V specimens were taken at stations classed H3. Most records (7 of 8, see table 29) came from stations classed H4 (four stations at the Hog Islands) or H5 (three stations, all at cays behind the Barrier Reef). In Belize the overwhelming majority of Group V specimens (76%) was taken at cays inside of the Barrier Reef (table 33).

ZOOGEOGRAPHIC IMPLICATIONS

The shorefishes of the tropical western Atlantic are perhaps better known than those of any other comparably sized tropical marine area. Despite this knowledge, there exists little agreement on major patterns of shorefish distribution in this area as evidenced by a number of competing and noncomplimentary schemes for major faunal assemblages, provinces, or generalized tracks (*e.g.*, Briggs, 1974; Miller, 1968; Robins, 1971b; Gilbert, 1973; Rosen, 1975). Three factors, at least, contribute to this situation: (1) lack of agreement among authors on the purposes of and best methodology for zoogeographic analysis, (2) a continuing need for synoptic systematic studies on numerous groups, and (3) a lack of adequate study material from a sizable proportion of the tropical western Atlantic, particularly the Caribbean coasts of Central America and northern South America (Gilbert & Kelso, 1971; Robins, 1971b, 1972). The purpose of these paragraphs is to strongly argue for the need for additional synoptic collecting in the western Caribbean by detailing the impact of our information on blennioid fishes from Belize and Honduras on one particular scheme for faunal provinces within the tropical western Atlantic area—that of Briggs, 1974.

Of the 57 blennioid species represented in our collections from Belize and Honduras, 20 species (table 1) represent new records for Belize, 40 species new records for Honduras, and 15 species are recorded for the first time from the Caribbean coast of Central America. Included in the material were representatives of four blennioid species new to science: (27) *Starksia occidentalis* Greenfield, 1978, (39) *Acanthemblemaria greenfieldi* Smith-Vaniz & Palacio, 1974, (44) *Emblemaria hyltoni* Johnson & Greenfield, 1976, and (47) *Emblemariopsis pricei* Greenfield, 1975.

Briggs (1974) divided the tropical western Atlantic into three zoogeographic provinces: Caribbean, Brazilian, and West Indian (Briggs, 1974, p. 63). Possibly the most striking feature of Briggs' proposal is that his West Indian Province [Bermuda, Bahamas, Greater and Lesser Antilles (to Granada)] is entirely insular. Briggs' disjunct Caribbean Province consists of southern Florida (east and west coasts), the Caribbean coasts of Central and northern South America, and the Mexican coast bordering the Gulf of Campeche. To Briggs (1974, p. 74), ". . . In zoogeography, the ultimate proof, as far as determination of provinces is concerned, is in the extent of endemism." We do not in this paper attempt to argue the merits of this dictum, but we are prepared to show that even in the supposedly well-known tropical western Atlantic arguments based on supposed levels of endemism may need to be severely modified.

Briggs (1974) defends his recognition of an entirely insular West Indian zoogeographic province (as distinct from his Caribbean Province) partly on the basis of evidence provided by Böhlke & Chaplin (1968) in their monumental contribution to our knowledge of the shorefishes of the Bahamas. Briggs states that of 466 shorefish species treated by Böhlke & Chaplin, 87 (about 19%) were unknown outside of the area of his West Indian Province.

Böhlke & Chaplin (1968) record 54 species of blennioid fishes from the Bahamas. According to information provided by them, one would conclude that 18 (33%) of these species were limited to Briggs' West Indian Province. Represented in our collections from Belize and Honduras are 13[6] of those 18 species, and a 14th (*Emblemariopsis bahamensis*) has also been reported from the western Caribbean (Birdsong & Emery, 1968). This leaves only four species of the 54 treated by Böhlke & Chaplin (1968) as putative West Indian endemics. Of these, one occurs at Isla de Providencia off Nicaragua (G. H. Burgess, pers. comm.), leaving only three species as putative West Indian endemics. Briggs (1974), to our knowledge, never states how high the percentage of endemism has to be in order to be ". . . the ultimate proof, as far as determination of provinces is concerned . . .," but we take it (Briggs 1974, *e.g.*, pp. 92, 95) that he would not consider 5.6% endemism (3[7] of 54) as sufficient supporting evidence to argue for a major zoogeographic province.

Three additional blennioid species[8] described subsequent to publication of Böhlke & Chaplin's (1968) book and known (at the time of original description) to occur only in the West Indian area, have now also been taken off Central America. Although we have identified only a small portion of the gobies from our collections in Belize and Honduras, preliminary results, summarized by Greenfield, 1978, suggest a developing picture similar to that for the blennioid

[6]The 13 species: 12, 16, 19, 22, 25, 26, 30, 33, 34, 36, 40, 42, 50.

[7]Now 2 of 54; see addendum (*Paraclinus naeorhegmis*).

[8]*Viz.*, *Emblemaria caldwelli*, *Emblemariopsis leptocirris*, *Starksia elongata*.

fishes. Yet it is groups such as the blennioids and gobiids that we might expect to best show a trend toward localized distributions (*e.g.*, Rosenblatt, 1963).

It seems likely that as additional material from new collections along the Caribbean coast of Central and northern South America becomes available and is studied, the distinctness of Briggs' West Indian Province, at least as based on Briggs' species-tally methodology, will further decline. This is not to say that regional endemism within the tropical western Atlantic area is lacking; there is good evidence to the contrary (see Greenfield, 1978). We do believe that until adequate synoptic collections are available from the western Caribbean area, attempts to use levels of endemism to define fish faunal provinces in the tropical western Atlantic region will prove to be exercises in futility.

In discussing the many curious disjunctions in distribution of species within his insular province, Robins (1971b) suggested that a combination of habitat specificity (the degree to which a particular species is associated with and restricted to a given set of habitat-defining parameters) and rather broadscale habitat patchiness might prove to be key clues to understanding such distributions. The discovery of typical coral-reef-associated fishes far north in the Gulf of Mexico at deep reefs is one example of this dependence on habitat availability rather than geography within the western Atlantic area (*e.g.*, Cashman, 1973; Smith et al., 1975; Sonnier et al., 1976; Smith, 1976). Our own work on blennioid fishes from Belize and Honduras suggests a spectrum in degree of habitat specificity, from species rather broadly distributed over the habitat categories recognized herein to species closely associated with a specific habitat type. Given that the parameters used to define a habitat category will greatly affect any view of degree of habitat specificity, it is also true that any test of the general applicability of Robins' suggestion will require additional attempts to determine environmental correlates of distribution for species in selected shorefish groups. Especially important will be attempts to define the degree of habitat specificity in a suitably broad and diverse area. Because of the diversity of habitats represented within a relatively restricted inshore to offshore distance, we believe Belize to be an ideal area in which to make such an attempt.

ADDENDUM
(October 1980)

We have taken and examined much additional blennioid material from Belize since this report was accepted for publication. For most of the species this new material confirmed distributional patterns described herein, and time did not permit the incorporation of all new records. In the new material, however, were specimens of six species previously unknown from Belize, including three not previously represented in any of our western Caribbean material. Locality records and, where appropriate, descriptive information are presented for these six species in this addendum. New records are also presented for 12 species previously represented in our material by four or fewer lots. Measurements (where given) are expressed as thousandths of the SL.

LABRISOMIDAE

(1) **Labrisomus albigenys** Beebe & Tee Van, 1928

This apparently rare species was previously reported from Belize by Birdsong & Emery (1968)—a single collection from Lighthouse Reef (UMML 9555) that we

have not had the opportunity to examine. One of us (RKJ) collected a single specimen (FMNH 93837, 40.9 mm SL) at Carrie Bow Cay in March 1980. The specimen was taken in the spur and groove province directly to the east of Carrie Bow Cay in 24 to 26 ft of water in an area of rich coral and moderately high relief. Data for the specimen (see table 7) follow: dorsal-fin elements, XVIII, 11: anal-fin elements, II, 16; pectoral-fin rays, 13/13; lateral line scales, 42/42; gill rakers on first arch (total), 15; head length, 367; interorbital width (bony), 39; eye diameter (fleshy orbit), 98; snout length, 100; dorsal fin, length of first spine, 98; pelvic fin, length of longest segmented ray, 269; upper jaw length, 125; ratio A (pelvic fin), 2.20; ratio B (nuchal cirri), 1.00.

(11) **Malacoctenus delalandei** (Valenciennes, 1836)

Additional material includes 86 specimens from six collections, all from sites well inshore of the Barrier Reef, five of the six collections from inshore cays. Coral rubble, extensive *Thalassia*, and a relatively firm bottom were common to all six sites.

Additional material: Toledo District, 78146 (13), Tarpon Cay, 0 to 5 ft; 78147 (6), West Snake Cay, 0 to 4 ft; 78148 (21), "Kulu" Cay, ca. 2 miles WNW of Moho Cay, mangrove-lined channel, extensive *Thalassia* offshore, coral rubble and occasional isolated clumps of *Porites* inshore, 0 to 4 ft; 78149 (27), Wilson's Cay, 0 to 4 ft; Belize District, 90279 (18), Spanish Cay, ca. 1.5 miles ESE of Robinson Point, coral rubble and *Thalassia*, adjacent to a pier, 0 to 3 ft; 90280 (1), mainland, point ca. 1 mile west of Little Rocky Point, in and around breakwater composed of large cobbles and surrounded by an extensive bed of *Thalassia*, 0 to 3 ft.

(16) **Paraclinus barbatus** Springer, 1955

Additional material includes 15 specimens from 10 collections, all from areas of rich coral development and high vertical relief, all from the deep spur and groove or dropoff zones. The specimens taken off Ambergris Cay represent the first record of this species from the Barrier Reef.

Additional material: Glovers Reef, 87839 (3), Northeast Cay, spur and groove, 70 to 90 ft; 87840 (1), Southwest Cay, spur and groove, 45 to 60 ft; 87841 (1), Long Cay, dropoff, 70 to 90 ft; 87842 (2), Long Cay, dropoff, 60 to 80 ft; 87843 (1), dropoff at western (leeward) reef, due west of Long Cay, 60 to 80 ft; 90299 (1), Long Cay, dropoff, 70 to 90 ft; 90300 (1), Middle Cay, spur and groove, 40 to 50 ft; 90301 (1), Northeast Cay, spur and groove, 80 to 100 ft; 94018 (2), Southwest Cay, dropoff, 70 to 90 ft. Corozal District, Ambergris Cay, 94019 (2), dropoff, 60 to 100 ft.

(17) **Paraclinus cingulatus** (Evermann & Marsh, 1900)

Additional material includes 10 specimens from three collections, constituting the first records for this species from Belize.

Additional material: Glovers Reef, 90302 (7), reef crest on windward side at Long Cay, limestone rock with rich algal turf grading to rich shallow reef (mostly *Acropora palmata*), 0 to 4 ft. Belize District at the Barrier Reef, 90303 (1), Sergeant's Cay, rich, shallow reef on windward side, 0 to 8 ft; 90304 (2), Goff's Cay, reef crest on windward side, rock and coral rubble grading to rich, shallow reef, 0 to 3 ft.

( ) **Paraclinus naeorhegmis** Böhlke, 1960

Two specimens (94020) from a single station at Ambergris Cay (1980) represent the first record of this species for Belize and a significant range extension for the species. Previously reported only from the Bahamas and from very few specimens (Böhlke & Chaplin, 1968, p. 519), *P. naeorhegmis* has also been taken at Isla de Providencia (G. H. Burgess & C. R. Gilbert, personal communication). The specimens from Ambergris Cay were taken from the "spur and groove province," a zone of eroded reef rock, sand channels, low relief, and few living corals, ca. 150 yd offshore from the crest of the Barrier Reef, in 34 to 36 ft of water. Data for the specimens (16.0, 16.1 mm SL, data given in that order) follow. Counts: dorsal-fin spines, xxvi (both); anal-fin elements, II, 15; II, 16; pectoral-fin rays, 13/13 (both); pelvic-fin elements, I, 2 (both); caudal fin, number of segmented rays, 13 (both). Measurements: body depth at dorsal-fin origin, 250, 248; body depth at anal-fin origin, 250, 261; caudal peduncle depth, 113, 118; dorsal fin, length of first spine, 200, 168, length of third spine, 100, 118; pectoral fin, length, 238, 255; pelvic fin, length, 206, 199; caudal fin, length, 263, 261; head length, 325, 342; eye diameter, 100, 112; upper jaw length, 163, 143; snout length, 69, 87.

(23) **Starksia elongata** Gilbert, 1971

Additional material includes a single specimen: 90342 (1), Glovers Reef, spur and groove province on the windward reef, rich coral development, 23 to 25 ft.

(24) **Starksia hassi** Klausewitz, 1958

Additional material includes a single specimen: 87855 (1), Glovers Reef, dropoff at western (leeward) reef, due west of Long Cay, 60 to 80 ft.

(28) **Starksia sluiteri** (Metzlaar, 1919)

Additional material includes 58 specimens from eight collections, all in less than 6 ft of water, all but one in areas of windward, rich, shallow reefs.

Additional material: Glovers Reef, 87876 (8), reef crest at Long Cay, 3 to 6 ft; 87877 (3), reef crest south of Long Cay, 2 to 6 ft; 90369 (21), reef crest at Long Cay, 0 to 4 ft; 90370 (8), reef crest at Long Cay, 0 to 5 ft. Belize District, at the Barrier Reef, 90371 (1), Sergeant's Cay, cobble, broken chunks of concrete, well-developed algal turf, 0 to 4 ft; 90372 (2), Goff's Cay, windward side, reef crest, rock and coral grading to rich, shallow reef, 0 to 3 ft. Corozal District, Ambergris Cay, barrier reef, 94021 (5), reef crest, 0 to 4 ft; 94022 (10), reef crest, 0 to 4 ft.

(29) **Starksia starcki** Gilbert, 1971

Additional material includes eight specimens from six collections constituting the first records for Belize. All specimens were taken in areas of rich coral development, high vertical relief, and in the spur and groove or dropoff provinces at two Barrier Reef sites (Carrie Bow Cay, Ambergris Cay) and at Glovers Reef. The material includes two adults (23.0 to 23.1 mm SL), both females, and six juveniles (10.0 to 17.3 mm SL). The color pattern (fig. 10) is striking, especially in the small juveniles—a series of 10, narrow, chocolate bars strongly contrasting with the pale cream background. The first (anteriormost) bar is con-

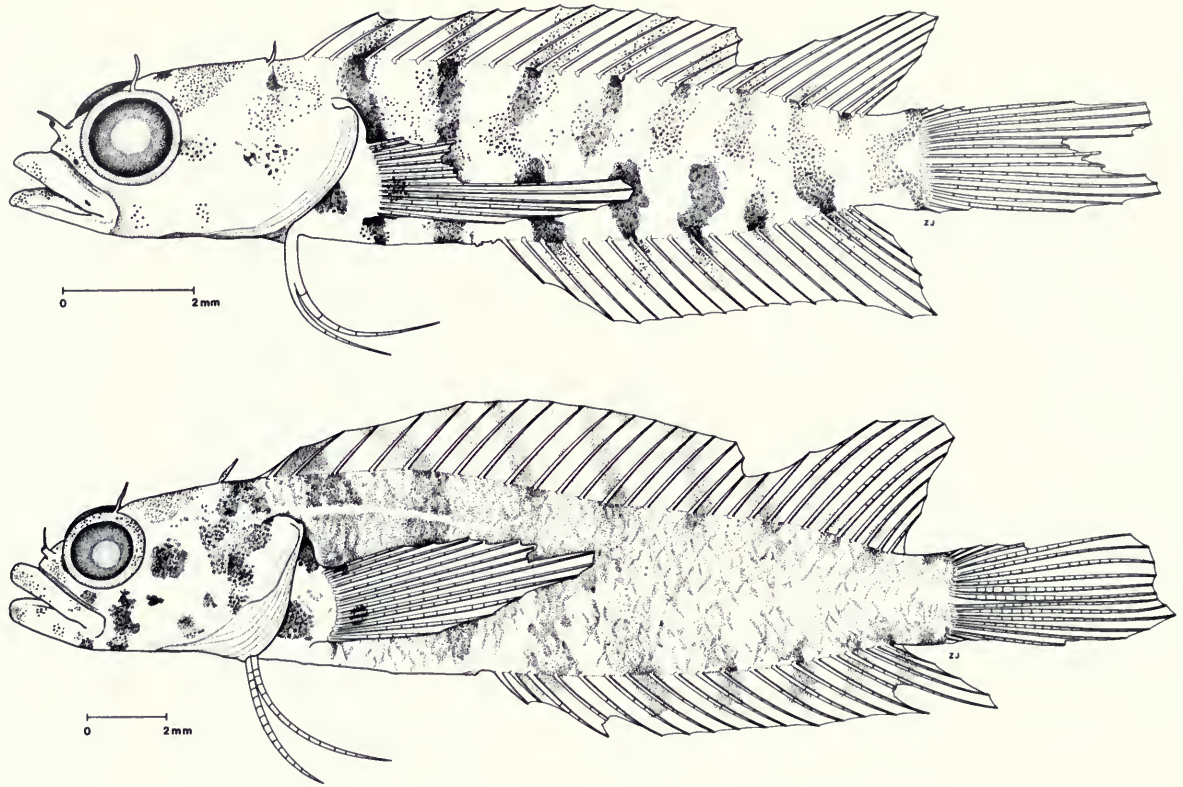

FIG. 10. *Starksia starcki* Gilbert, 1971. **Above,** FMNH 93834, juvenile, 10.0 mm SL. **Below,** FMNH 93836, female, 23.1 mm SL.

tinuous across the nape and extends ventrally to a point on the gill covers directly anterior to the insertion of the two to three ventralmost pectoral-fin rays. The next three bars are continuous from the dorsal to the ventral contours of the body. The next five bars are broken midlaterally on the body, with the epaxial portion anteriorly offset from the corresponding hypaxial portion. The final bar consists of the "hypural" markings. In the two adult specimens the barred pattern is much less evident, due in part to the more even spread of pigmentation over the body. The nine bars on the body so evident in the juveniles are best marked in the adults by the presence of blotches of pigment on the dorsal and ventral contour adjacent to the dorsal- and anal-fin ray bases and by a barred pattern on the dorsal and anal fins. Additional concentrations of pigment on the head and associated with the pectoral fin are as described in Gilbert (1971, p. 201).

There are 11 pores in the infraorbital series (based on the two adult specimens only), extending from a point just anterior to the orbit and on a horizontal line through the center of the eye (3:00 position; descriptions of pore positions based on lateral view of right side) to a point adjacent to the dorsoposterior margin of the orbit on a horizontal line through the base of the orbital cirrus (11:00). Contrary to Gilbert's (1971, p. 200) description, pores 4 and 5 (6:00) and 8 and 9 (9:00) are paired in the Belize material. One paratype (UF 17279, 20.5 mm SL) is identical to the Belize specimens in pore number and configuration. Two larger paratypes (ANSP 109800, 27.2 mm SL; USNM 205200, 27.0 mm SL) have one or more additional pores, with the configuration differing slightly between the right and left side (in each case), but the pores at the 6:00 and 9:00 positions are paired as in the Belize material.

Meristic characters (based on all eight specimens): dorsal-fin elements, XX, 8 (1); XX, 9 (7); anal-fin elements, II, 18 (all); pectoral-fin rays, 13 (all); pelvic-fin elements, I, 2 (all). Morphometric characters (expressed as thousandths of the SL, based on four specimens, 16.3, 17.3, 23.0, 23.1 mm SL, and listed in that order): head length, 344, 341, 335, 333; snout length, 61, 64, 74, 74; upper jaw length, 135, 127, 157, 134; horizontal eye diameter, 92, 110, 113, 108; greatest depth of body, 202, 202, 222, 216; dorsal fin, length of first spine, 86, 87, 91, —; pectoral fin, length of longest ray, 301, 289, 291, 281; pelvic fin, length of longest segmented ray, 245, 243, 222, 221; caudal fin, length of longest ray, —, 289, —, 255.

Additional material examined: Glovers Reef, 94023 (1), western (leeward reef), spur and groove, 30 to 35 ft. Corozal District, Ambergris Cay, 94024 (1), spur and groove, 58 to 62 ft; 94025 (1), dropoff, 70 to 100 ft. Stann Creek District, at the Barrier Reef, 93834 (2), Carrie Bow Cay, spur and groove, 24 to 26 ft; 93835 (2), Southwater Cay, spur and groove, 35 to 45 ft; 93836 (1), Curlew Cay, spur and groove, 23 to 26 ft.

(30) **Stathmonotus gymnodermis** Springer, 1955

Additional material includes five specimens from one collection: 90318 (5), Glovers Reef, reef crest on windward side at Long Cay, limestone rock with rich algal turf grading to rich, shallow reef (mostly *Acropora palmata*), 0 to 4 ft. Meristic characters: dorsal-fin spines, XLI (1), XLII (4); anal-fin elements, II (all), 22 (1), 23 (3), 24 (1); pectoral-fin rays, 8 (all); caudal fin, segmented rays, 11 (all).

(31) **Stathmonotus hemphilli** Bean, 1885

Additional material includes four specimens from three collections, constituting the first records of this species from Belize: 90319 (2), Glovers Reef, spur and groove province on windward side, south of Long Cay, rich coral development with high vertical relief, 22 to 25 ft. Corozal District, Ambergris Cay, 94026 (1), cut in barrier reef, steep-sided channel, eroded reef rock, little living coral, 35 to 38 ft, 94027 (1), dropoff, 80 to 92 ft.

CHAENOPSIDAE

(40) **Acanthemblemaria maria** Böhlke, 1961

Additional material includes 11 specimens from a single station, Corozal District, Ambergris Cay, at the Barrier Reef, 93977, reef crest; rich, living coral formations bordered by extensive areas of cobble and coral rubble, 0 to 4 ft.

( ) **Chaenopsis ocellata** Poey, 1865

This species is known from the Bahamas, Florida, and the Greater Antilles (Böhlke & Chaplin, 1968). This constitutes the first record for Belize and a significant range extension for the species. Our three collections (83929, 6 specimens, 34.7-44.5 mm SL; 83930, 8 specimens, 34.5-64.1; 83931, 17 specimens, 32.9-62.8) were all collected from a *Thalassia* bed in 6 to 25 ft of water on the leeward side of a patch reef in the lagoon at Glovers Reef, about 1.5 miles west of Long Cay. The colony was living in holes in the fine sand among the *Thalassia*. Individuals were usually observed with the anterior portion of their body extending from a hole, but occasionally individuals were observed swimming through the *Thalassia* or hanging in the water among the *Thalassia* blades.

(42) **Coralliozetus cardonae** Evermann & Marsh, 1899

Additional material includes two specimens (14.4, 18.8 mm SL) taken at a single station, Corozal District, Ambergris Cay, at the Barrier Reef, 94017, reef crest, rich, living coral formations bordered by extensive areas of cobble and coral rubble, 0 to 4 ft. Counts, identical in the two specimens, follow: spinous dorsal, 18; soft dorsal, 11; total dorsal-fin elements, 29; anal-fin elements, II + 19; pectoral-fin rays, 13.

(45) **Emblemaria pandionis** Evermann & Marsh, 1900

Additional material includes 14 specimens from five collections, none of them areas of rich coral.

Additional material: Glovers Reef, windward side, lagoon edge of leeward reef flat, 90510 (1), in lagoon off Middle Cay, extensive *Thalassia*, sand, and isolated pieces of rubble, 5 ft; 93987 (1), in lagoon between Long Cay and Middle Cay, extensive *Thalassia*, sand, and isolated pieces of rubble, 4 to 5 ft. Glovers Reef, 93988 (1), channel between Northeast Cay and Long Cay, "blowout" (sand and rubble-lined basin) in extensive *Thalassia* bed, 4 to 6 ft. Corozal District, Ambergris Cay, 93989 (6), "spur and groove province," a zone of eroded reef rock, sand channels, low relief, and few living corals, 34 to 36 ft; 93990 (5), cut in Barrier Reef, steep-sided channel, eroded reef rock, little living coral, 35 to 38 ft.

( ) **Emblemaria** cf. **piratula** Ginsburg & Reid, 1942

A small (12.7 mm SL, male) specimen of *Emblemaria* taken by Dr. Brian Kensley (Station K-22, 7 February 1978, in a rubble sample from 90 ft close to the outer wall of the deep channel off Carrie Bow Cay) is herein tentatively identified as *Emblemaria piratula*. This species has heretofore been reported only from the northeastern Gulf of Mexico (Stephens, 1963, p. 89; Shipp, 1975, p. 16, Johnson & Greenfield, 1976, p. 27). This record from Belize, assuming the correctness of our identification, represents a significant range extension for the species.

The Belize specimen exhibits lower dorsal- and anal-fin counts than reported values for Florida specimens: dorsal-fin elements, XIX, 13, total = 32 (vs. XVIII to XIX, 14 to 16, total = 33 to 34); anal-fin elements, II, 19, total = 21 (vs. II, 21, total = 23). Values for the pectoral fin, 13 (vs. 12 to 13) and pelvic fin, I, 2 (the third soft pelvic-fin ray is vestigial in *E. piratula*, only two segmented rays are evident) agree with reported values for Florida specimens. As in *E. piratula* (Johnson & Greenfield, 1976, p. 19), there are apparently three CP pores, and a line connecting the two posteriormost ST pores lies entirely anterior to the dorsal-fin origin. The orbital cirri are elongate, ca. 50% of the head length. Aside from a few scattered melanophores on the head, anterior body, and anterior dorsal fin, the Belize specimen lacks pigmentation. The small size of the specimen and lack of any additional Belize material precludes any final taxonomic decision.

(49) **Hemiemblemaria simulus** Longley & Hildebrand, 1940

Additional material includes six specimens from five collections: Honduras, 90522 (1), Little Hog Island, rock ledges and cobble inshore grading to small but well-developed coral formations offshore, 0 to 20 ft; Belize, Glovers Reef, spur and groove province off Northeast Cay, 80 to 90 ft, 90523 (1), 94009 (1). Belize District, at Barrier Reef, 90524 (1), Sergeant's Cay, rich shallow reef on windward side, 0 to 8 ft. Corozal District, Ambergris Cay, 94010 (2), cut in Barrier Reef, steep-sided channel, eroded reef rock, little living coral, 35 to 38 ft.

BLENNIIDAE

(52) **Hypleurochilus aequipinnis** (Günther, 1861)

Additional material includes 48 specimens from seven collections. Remarkable among these new specimens was a series of 11 (37.0 to 53.6 mm SL) taken on the Belize mainland at a point ca. 1 mile west of Little Rocky Point (Belize District). This series included the largest-bodied specimens yet taken in Belize or Honduras, including a number of mature males with one enormously prolonged orbital cirrus on each side (fig. 11). Randall (1966, p. 58) had reported prolongation of one of the orbital cirri on each side in mature males of *Hypleurochilus fissicornis* (Quoy & Gaimard, 1824) and *H. springeri* Randall, 1966. The condition in *H. fissicornis* was said to be remarkable among species of *Hypleurochilus* in that the length of the prolonged cirrus was contained about 1.6 times in the head length. In two of the largest male *H. aequipinnis* from the mainland series, 50.0 and 53.6 mm SL, the orbital cirrus is contained 1.3 and 1.4 times, respectively, in the head length. Counts and selected mensural characters for Belize and Honduras material (N = 10, 22.9 to 53.6 mm SL) follow: dorsal-fin elements, XII (all),

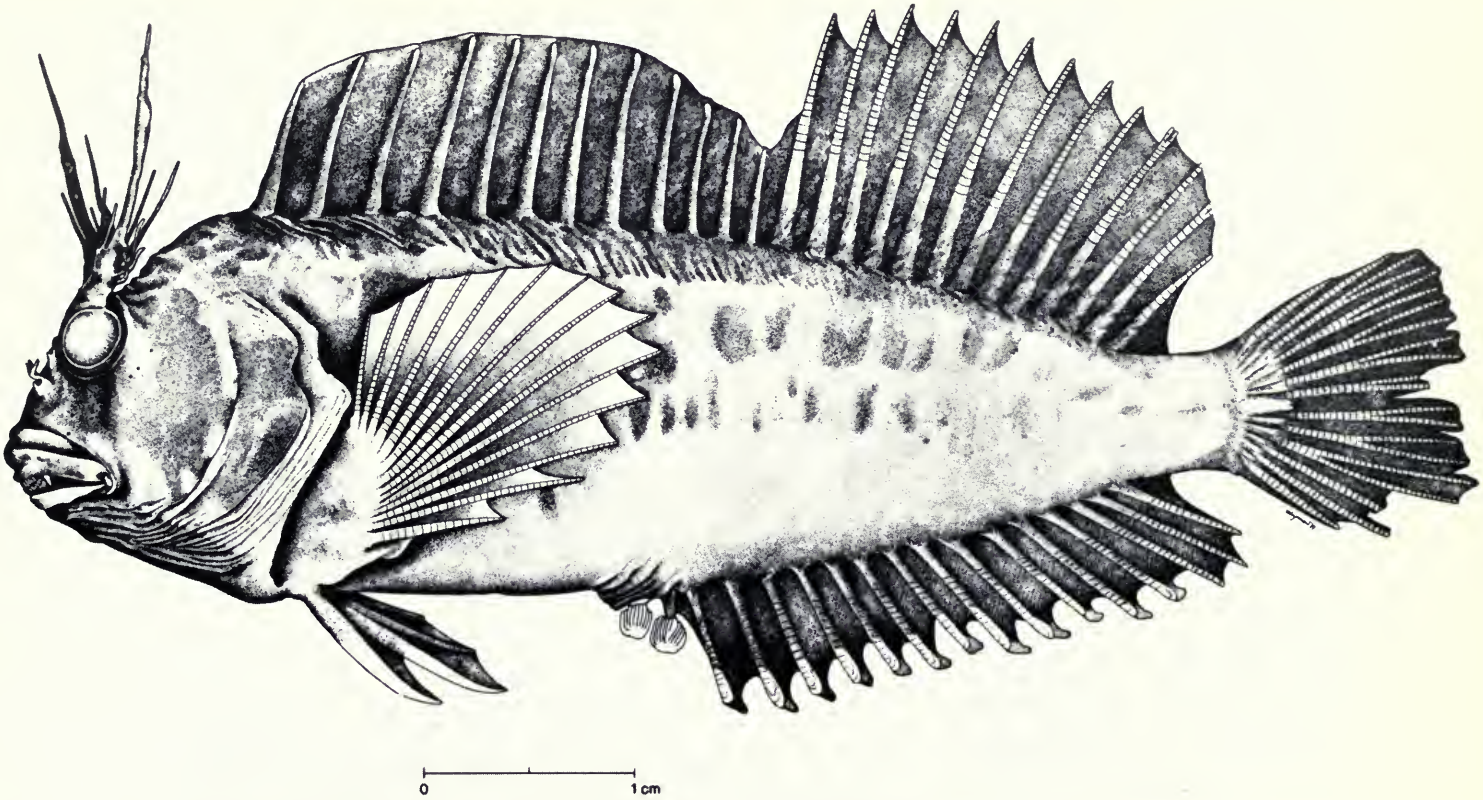

FIG. 11. *Hypleurochilus aequipinnis* (Günther, 1861) FMNH 93833, male, 53.6 mm SL.

13 (3), 14 (7); anal-fin elements, II (all), 15 (5), 16 (5); pectoral-fin rays, 14 (all); pelvic-fin elements, I, 4 (all); vertebrae, 31 (8), 32 (2); number of orbital cirri (left side only), 5 to 16, all specimens exceeding 37 mm SL (8 of 10 counted) with 10 or more; dorsal fin, length of last spine, 33% to 57% of length of first ray of soft dorsal fin; pectoral fin length contained 3.7 to 4.7 times in SL.

All of the additional material was taken in very shallow water (less than 10 ft). Of the seven additional localities, five were at mangrove-covered cays inside the Barrier Reef, two were mainland sites.

Additional material: 87952 (1), Toledo District, Frenchman's Cay, coral rubble and algal turf, 0 to 5 ft; 87953 (1), Toledo District, "Unnamed Cay," ca. 2.5 miles WSW of Wilson's Cay, mangrove channel with an extensive offshore *Thalassia* bed, 0 to 4 ft; 87954 (1), Belize District, cay at Robinson Point, mangrove channel, 0 to 10 ft; 87955, Toledo District, "Kulu" Cay, ca. 2 miles WNW of Moho Cay, mangrove channel with extensive offshore *Thalassia* bed, 0 to 4 ft; 93833, Belize District, mainland, point ca. 1 mile west of Little Rocky Point, in and around breakwater composed of large cobbles and surrounded by an extensive bed of *Thalassia*, 0 to 3 ft. Corozal District, Chetumal Bay, 93955 (1), Cayo Negro, eroded reef rock inshore, *Thalassia* offshore, 0 to 3 ft; 93956 (31); mainland, Punta Allegre, eroded and undercut reef rock along shore, sand and *Thalassia* offshore, 0 to 3 ft.

Comparative material examined. *H. aequipinnis:* USNM 88988 (1), Dominican Republic; USNM 120341 (1), Puerto Rico; USNM 192242 (2), Ascension Bay, Yucatan; USNM 192400 (2), Cozumel, Quintana Roo; USNM uncat. (4), Bahia Limon, Panama. *H. bermudensis:* FMNH 48709 (1), Bermuda; FMNH 48817 (1), Bermuda; FMNH 49401 (2), Bermuda; FMNH 62261 (2), Florida, USNM 116805 (8), Tortugas. *H.* cf. *geminatus:* FMNH 40295 (1), Texas; 50734 (10), Florida; USNM 208444 (4), Texas; USNM 217324 (3), Louisiana. *H. fissicornis:* BMNH 1868.9.22.9 (14), Brazil; BMNH 1891.9.30.1 (1), Uruguay. *H. springeri:* USNM 219141 (1), Puerto Rico.

(54) **Lupinoblennius dispar** Herre, 1942

Additional material includes nine specimens from four collections: Belize District, 90470 (4), mainland, ridge of dredge spoil at entrance to Salt Creek, mud and cobbles, 0 to 2 ft; 90471 (1), mainland, point ca. 1 mile west of Little Rocky Point, in and around breakwater composed of large cobbles and surrounded by an extensive bed of *Thalassia*, 0 to 3 ft; 90472 (1), Moho Cay, opposite St. John's College, Belize City, mangrove shoreline, steep mud bank, 0 to 3 ft. Corozal District, Chetumal Bay, 93958 (3), Punta Allegre, eroded and undercut reef rock along shore, sand and extensive *Thalassia* offshore, 0 to 3 ft. At each of the above stations (except the one at Moho Cay), *L. dispar* was taken with (18) *Paraclinus fasciatus* and (52) *Hypleurochilus aequipinnis*. At the station near Little Rocky Point, (8) *Labrisomus nuchipinnis* and (11) *Malacoctenus delalandei* were also taken.

(56) **Parablennius marmoreus** (Poey, 1875)

Additional material includes five specimens from two collections, both from mangrove-covered cays inside the Barrier Reef: 87948 (1), Toledo District, "Kulu" Cay, ca. 2 miles WNW of Moho Cay, mangrove channel with an extensive offshore *Thalassia* bed, 0 to 4 ft; 97949 (4), Toledo District, "Unnamed Cay," ca. 2.5 miles WSW of Wilson's Cay, mangrove channel with an extensive offshore *Thalassia* bed, 0 to 4 ft.

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